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IN-SERVICE TEACHERS' ABILITY TO INTEGRATE INSTRUCTIONAL TECHNOLOGY INTO LESSONS BASED ON SAMR LEVEL OUTCOMES AND THEIR PERCEIVED EASE OF USE, PERCEIVED USEFULNESS, AND SELF-EFFICACY

A Dissertation

Submitted to the School of Education

Duquesne University

In partial fulfillment of the requirements for

the degree of Doctor of Education

By

Jordan L. Cotten

May 2021

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2021

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By

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ABSTRACT

IN-SERVICE TEACHERS' ABILITY TO INTEGRATE INSTRUCTIONAL TECHNOLOGY INTO LESSONS BASED ON SAMR LEVEL OUTCOMES AND THEIR PERCEIVED EASE OF USE, PERCEIVED USEFULNESS, AND SELF-EFFICACY

By

Jordan L. Cotten

May 2021

Dissertation supervised by Dr. David D. Carbonara

The purpose of this study was to determine in-service teachers' ability to integrate instructional technology into their lesson plans. The Technology Acceptance Model 2 (TAM 2) survey was used to measure self-reported perceived ability of technology integration. Teacher self-efficacy, computer self-efficacy, and self-efficacy towards technology integration questions will be used to measure self-reported self-efficacy levels. The Substitution, Augmentation, Modification, and Redefinition (SAMR) model was used to determine the level of integration in-service teachers actually incorporated. Participants (n = 131) were teachers from a suburban public K-12 school district in the northeastern region of the United States. Results showed that participants felt confident in using technology, perceived the use of technology important for their job, and that technology was perceived as easy to use. However, self-reported self-efficacy

and TAM 2 scores were found to be statistically different from lesson plan integration SAMR levels.

DEDICATION

I dedicate this dissertation to my husband, Fabian, and children – Sloane, Declan, Fallyn, and Callen. My family has never stopped their unwavering support for my success and completion of this milestone. Thank you for all your love and encouragement throughout this process.

ACKNOWLEDGEMENT

My sincere gratitude goes to my dissertation chair, Dr. Carbonara. Your guidance and dedication throughout this research study have been immeasurable and appreciated. I would also like to acknowledge my committee members, Dr. Kush, Dr. Scigliano, and Dr. Serenka for all of your feedback and advice throughout the entire process. All of you have held me to the highest standard and I have gained so much. Thank you for giving me the opportunity to be a part of this life-changing journey.

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Chapter 1: Introduction

Introduction

Instructional technology integration by pre- and in-service teachers has been a popular research topic over the past twenty years. Many scholars have investigated topics such as how self-efficacy and attitudes affect the ability to integrate technology, technology acceptance, and barriers to using technology (Ertmer, 1999; Palak & Walls, 2009; Spaulding, 2013; Teo, 2009b). One topic of particular interest was the use of the Technology Acceptance Model (TAM) to predict instructional technology integration by pre-service and in-service teachers (Teo, 2009b). This study adopted the TAM, which is seen as the most widely used model of technology acceptance (Adewole-Odeshi, 2014; Cakir & Solak, 2015; & Park, S. Y., 2009).

Though scholars have used TAM and TAM 2, an extended version, to predict technology use in future and current classrooms by teachers, there has been little follow up to see if these teachers are integrating technology according to their self-reported measures on the TAM survey instrument (Davis, 1989). Davis et al. (1989) narrowed the focus of the TAM survey to predicting technology usage and Venkatesh & Davis (2000) extended this model to include the social influences and cognitive processes of perceived usefulness and perceived ease of use. With the inclusion of the external variables (social influences and cognitive processes) in the TAM 2, this study adopted this version to ascertain the teachers' self-reported perceived abilities to use instructional technology in their lessons. By incorporating Puentedura's (2006) SAMR (Substitution, Augmentation, Modification, and Redefinition) model to evaluate lesson plans submitted by in-service teachers in this study, the evidence may show whether self-reported TAM 2 measures are connected to implemented technology integration found in teachers' lesson plans. Figure 1 illustrates all components of this study and their connection to SAMR as the dependent variable. The illustration provides an overview of the overarching themes of the research conducted in this study. Each component is thoroughly explored in the literature review.

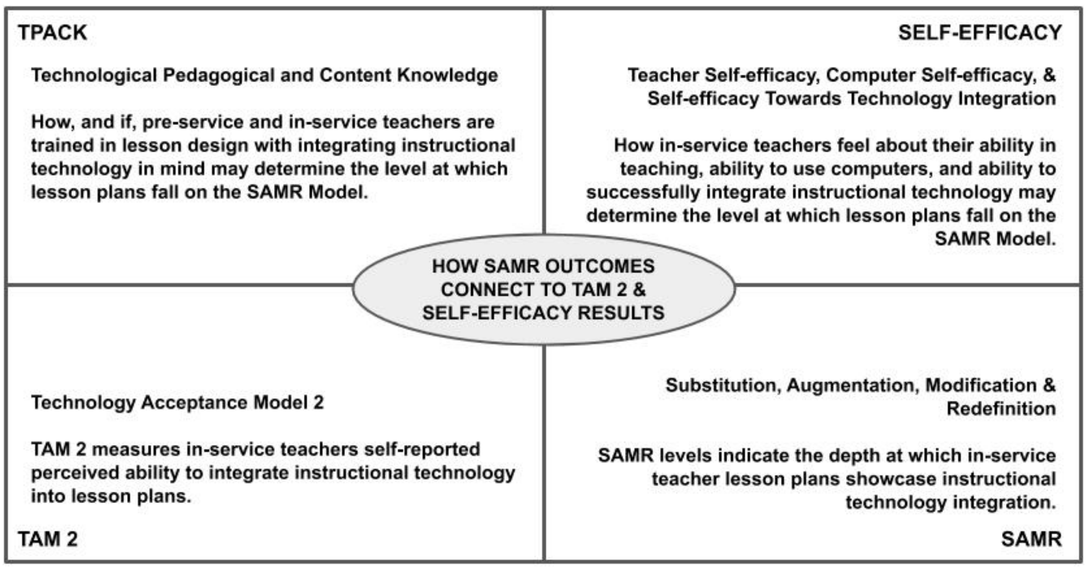

Figure 1. Illustration of research study components.

Rationale for the Study

Much of the current literature questions the predictability of the future use of instructional technology by current pre-service teachers (Aslan & Zhu, 2015; Lee & Lee, 2014; Sadaf et al., 2016; Teo, 2009a; Tondeur et al., 2012). Sadaf et al. (2016) targeted pre-service teachers' intentions to use instructional technology in their future classrooms and then followed this up with investigating their progress during their student teaching. Results from this study indicated a positive relationship between pre-service teachers' intentions of integrating instructional technology and their subsequent actions. Background knowledge surrounding pre-service teachers' preparation for future instructional technology integration was found to be essential in understanding the difference between pre-service and in-service teachers' instructional technology preparation for integration in the classroom (Tondeur et al., 2017).

In-service teachers are offered professional development on how to integrate technology into their lesson plans but there is an insignificant amount of literature about in-service teachers' beliefs on how to integrate technology into their lesson plans (Ertmer, 2005; Hughes, 2005; Spaulding, 2013). Based on Bandura's Self-Efficacy Theory (1977) and using Vanketesh & Davis' (2000) Technology Acceptance Model 2 (TAM 2) survey to measure self-reported perceived ability of technology integration, the perceived ease of use and perceived usefulness of instructional technology integration of in-service teachers can be evidenced. In addition, self-efficacy questions from Kiili et al. (2016) will be used to determine in-service teachers' levels of self-efficacy in three areas: computer self-efficacy, teaching self-efficacy, and self-efficacy towards technology integration. The SAMR model will be used to show outcome effects by examining submitted lesson plans that identify the level of integration in-service teachers actually incorporated.

Pre-service and In-service Teacher Instructional Technology Training

Pre-service teachers receive instruction from their teacher preparation programs on how to integrate technology into their lessons as viewed from the requirements for teaching certifications on the websites of universities such as Temple (https://www.temple.edu/), Kent State (https://www.kent.edu/), Slippery Rock (https://www.sru.edu/) and California University of Pennsylvania (https://www.calu.edu/). Pennsylvania State University (https://www.psu.edu/) and Duquesne University (https://www.duq.edu/) also requires technology integration embedded throughout their education programs.

Aslan and Zhu (2015) identified pre-service teachers' perceptions of Information and Communication Technology (ICT) integration and its association with their teaching practices and found there should be specific conditions for ICT integration in teacher education and that more hands-on experiences may result in better use of ICT integration in future teaching practices. Similarly, Teo (2009a), examined the relationship between pre-service teachers' self-efficacy beliefs and their intended use of technology for teaching while working in the capacity of a student teacher. Teo found a significant relationship between the perception of one's ability to use technology and how a person plans - not actual use - to use technology in teaching.

Sadaf et al. (2016) investigated the factors that predict pre-service teachers' intentions to use Web 2.0 tools and then, in a follow-up phase, explored their transfer of intentions of how they actually used the tools during their student teaching. Their findings indicated that perceived usefulness, self-efficacy and student expectations were strong predictors of intentions to use the tools. Furthermore, during the follow-up phase, the teachers were able to transfer most of their intentions into action but found that some were challenged to do so due to limited access to technology and unsupportive mentor teachers. While these studies illustrate attempts to predict the behavior of pre-service teachers to integrate technology when they become in-service teachers, no follow-up measures were conducted to determine if their predictions were an accurate indication of technology integration once they were in-service.

While some literature focuses on in-service teachers' ability to integrate instructional technology, other literature is available to evaluate implementation and self-reported beliefs, but not focus on outcomes (Moore-Hayes, 2011; Spaulding, 2013). The literature for in-service teachers tends to focus on one kind of technology, predicting if they will use instructional technology, or investigates the strategy in which they deliver content (Clausen, 2007; Davidson et al., 2014; Davis & Eslinger, 2001; Hamdani, 2019; Pan & Franklin, 2011; Turel, 2014).

The purpose of this study was to determine if the level of integration of technology into in-service teachers' lesson plans as measured by a SAMR rubric relates to self-reported perceived ease of use as measured by the Technology Acceptance Model 2 (TAM 2) survey. In the past, self-efficacy would have been measured to determine the level of technology integration. This study used the perceived ease of use value to determine the level of technology integration. In using the SAMR model as an evaluative tool, a comparison was made of the actual integration of instructional technology via teacher submitted lesson plans. By determining on which level of the SAMR model the technology used in each lesson lands, a connection was made back to one's perception of perceived ease of use of instructional technology integration.

Theoretical Framework for the Study

Self-efficacy of Pre-service and In-service Teachers Technology Skills

Albert Bandura's Self-Efficacy Theory (1977) is a component of Bandura's Social Cognitive Theory (1986) that explains how a person's belief in their own ability to accomplish a task will affect their performance in the outcome of that particular task. Bandura (1977) "hypothesized that expectations of personal efficacy determine whether coping behavior will be initiated, how much effort will be expended, and how long it will be sustained in the face of obstacles and aversive experiences" (p. 191). Bandura (1993) further states that "efficacy beliefs contribute significantly to the level and quality of human functioning" (p. 145). A popular use for Bandura's Self-Efficacy Theory is to understand why certain beliefs affect the way teachers behave in the context of instructional technology. All teachers have beliefs about the skills they have and they use these beliefs to perform their job (Bandura, 1993; Davis, 1989). Using their belief systems, teachers execute their job based on how well they believe they can perform certain tasks (Bandura, 1982). To perform these tasks, teachers behave in a way that reflects their beliefs combined with what they have to do to accomplish a new task (Bandura, 1977; Palak & Walls, 2009). The new task here would refer to integrating instructional technology into a teacher's lesson plan.

Pre-service teachers' beliefs about their innate ability to integrate instructional technology is heavily reported in the literature (Abbitt, 2011; Efe & Efe, 2016; Elstad & Christophersen, 2017; Gulbahar, 2008; Keser et al., 2015; Nadelson et al., 2013; Sadaf et al., 2016; Sadaf et al., 2012; Sahin et al., 2013; Sang et al., 2010; Teo, 2009a).

Trying to identify how and why teachers integrate instructional technology has been a major research focus within the education community. Researchers have found that teachers who have high levels of self-efficacy regarding instructional technology tend to integrate it more into their lessons (Lai, 2005; Palak & Walls, 2009; Teo, 2009a; Tunkler et al., 2016). Teachers need to effectively integrate instructional technology seamlessly into their classrooms and levels of self-efficacy can assist with or hinder this objective (Mirzajani et al., 2015; Sadaf et al., 2016).

In-service teachers have not received enough professional development on how to integrate technology into their curriculum (Geer et al., 2017; Reid, 2014) which may produce beliefs of being inadequate in knowing how to integrate technology into their daily lessons (Ertmer & Ottenbreitt-Leftwich, 2010; Spaulding, 2013; Uslu & Bumen, 2012). This belief may interfere with teachers' capability of learning new teaching techniques or strategies such as integrating technology (Adegbenro et al., 2017; Williams, 2017). Just as pre-service teachers face challenges to using instructional technology, in-service teachers may also face challenges that are reasons why they do not use technology. Some of these reasons are a lack of professional development, lack of access to technology, low self-efficacy beliefs, and school culture (Ertmer, 1999; Hsu, 2005; Kim et al., 2013; Li et al., 2015; Mirzajani et al., 2015; Reid, 2014).

Both pre-service and in-service teachers enact their beliefs of their strengths in performing certain tasks. These beliefs could develop out of past performances or their own personal judgement of how well they believe they can execute the task. Self-efficacy represents this personal judgement and sets the course of action for one to integrate instructional technology into his/her lesson plans. Learning how to use technology and integrating it effectively is a learned behavior. The goal of this study will be to determine the relationship between in-service teachers' levels of perceived ease of use and perceived usefulness as measured by the TAM 2 and levels of integration of instructional technology in lesson plans designed for K-12 subjects as measured by SAMR.

Lesson Planning with Integrating Technology in Mind

Pre-service teachers gain experience designing lesson plans with instructional technology integration during their teacher education program. However, in-service teachers have to wait for planned professional development in their school district or be motivated to seek out their own avenues for professional development to learn how to effectively integrate instructional technology into their lesson plans. Designing lesson plans that are enhanced by technology is a learned behavior (Lee & Lee, 2014; Pamuk, 2012; Summerville & Reid-Griffin, 2008; Thorsteinsson, 2012; Ünal et al., 2017). Ünal et al. (2017) found that pre-service elementary teachers' technology integration self-efficacy (TISE) increased after their participation in a teaching practice course. Pre-service teachers in this course received real-time classroom experience and the opportunity to design technology-enhanced lessons (Ünal et al., 2017).

Pre-service teachers usually take required instructional technology integration courses in their teacher preparation programs to help prepare them for their role as an in-service teacher (Aslan & Zhu, 2015; Mouza et al., 2014; Ünal et al., 2017). As viewed on their university websites, universities such as California University of Pennsylvania (https://www.calu.edu/), Slippery Rock University (https://www.sru.edu/), Kent State

University (https://www.kent.edu/), Temple University (https://www.temple.edu/), and Indiana University of Pennsylvania (https://www.iup.edu/), located in the northeast region of the United States where this study will take place, offer a required stand-alone instructional technology course. A question about which university study participants attended for their teacher preparation programs will be added to the survey instrument. Other programs, such as Pennsylvania State University (https://www.psu.edu/) and Duquesne University (https://duq.edu/) integrate effective instructional technology use throughout all courses within the program of study. Tondeur et al. (2012) reviewed nineteen qualitative studies regarding pre-service teacher education training programs and reported finding key themes related to pre-service teacher training such as aligning theory and practice, using teacher educators as role models, learning technology by design, access to resources, among eight more. Programs are providing courses that focus on teacher candidates creating technology-embedded lessons, but this is inconsistent across different preparation programs (Tondeur et al., 2012).

In-service teachers receive some professional development on integrating technology utilizing the TPACK and SAMR frameworks. These frameworks are used to help teachers with low self-efficacy begin to integrate instructional technology and assist those with high self-efficacy to go even further with their integration efforts. These professional development offerings are also inconsistent across school districts and states. Teacher leaders have begun to focus on these inconsistencies to help prepare both pre- and in-service teachers to effectively integrate technology into their lessons.

In-service teachers' intention of integrating instructional technology to support teaching and learning relies heavily on their self-efficacy beliefs (Bandura, 1993; Ertmer et al., 2012; Kim et al., 2013; Li et al., 2015; Turel, 2014). The Technological Pedagogical and Content Knowledge (TPACK) framework can help with effective instructional technology integration and planning (Mishra & Koehler, 2006).

The TPACK framework should be incorporated to assist in-service teachers with a clear vision of the instructional design process and giving an effective way for teachers to plan, implement, and evaluate the integration of instructional technology into daily lessons (Ertmer, 1999; Summerville & Reid-Griffin, 2008). It has been found that teacher instructional technology self-efficacy levels have predicted TPACK competencies (Abbitt, 2011; Keser et al., 2015). Teachers in the school district in this study have been exposed to TPACK competencies; however, the framework has not been widely incorporated across all schools and grade levels.

TAM 2 and Teacher Level of Acceptance of Instructional Technology

In order to help predict and explain in-service teachers integration of instructional technology, this study used the TAM 2 (Venkatesh & Davis, 2000). TAM was developed to determine if a user of technology would use it or not (Davis, 1985). While Davis (1985) based the TAM on Fishbein & Ajzen's (1975) Theory of Reasoned Action (TRA), which is a more generic model, Davis et al. (1989) narrowed its use to focus on predicting technology use. The level at which instructional technology is integrated in teachers' lesson plans will be evaluated using the SAMR model. This study will look for the relationship between TAM 2 scores, self-efficacy scores and SAMR levels.

The original TAM model, developed by Davis (1985), only included the variables perceived ease of use and perceived usefulness to help predict if users of a new technology will use the new technology. Davis (1989) used Bandura's research on self-efficacy to support the importance of perceived ease of use and perceived usefulness as basic determinants of user behavior. The TAM has been empirically proven to show a user's acceptance of technology (Teo, 2009b). Bandura (1982) believed that human behavior is predicted by both self-efficacy and outcome judgments. Chutter (2009) believed there is a link between self-efficacy and perceived ease of use and outcome judgments and perceived usefulness. Venkatesh and Davis (2000) took the TAM a step further by including variables that explain perceived ease of use and perceived usefulness in terms of social influences (subjective norm, voluntariness, image) and cognitive instrumental processes (job relevance, output quality, results demonstrability, perceived ease of use) to create the TAM 2. In the expanded TAM 2, Venkatesh and Davis (2000) have given the ability to determine which variables influence perceived ease of use and perceived usefulness and predict which teachers are more likely to integrate instructional technology into their lessons.

With the focus of teacher leaders on preparing teachers to integrate instructional technology, TAM 2 is a tool to highlight teachers' perceived usefulness of integrating technology and their perceived ease of use of integrating technology (Jonas & Norman, 2011; Wingo, Ivankova, & Moss, 2017; Wu et al., 2011). The goal of this study was to use the TAM 2 to determine which characteristics of teacher knowledge and practice influence in-service teachers' technology integration into their lesson plans. This study used the SAMR model to evaluate the level of integration of technology as explained in the next section.

SAMR as a Measurement Outcome of Technology Integration in Lesson Plans

While TPACK helps with the design process as discussed previously, the SAMR model is a useful tool to evaluate the outcomes of the level of integration of technology teachers implement into their lesson plans (Nkonki & Ntlabathi, 2016; Phillips, 2015; Puentedura, 2006; Tseng, 2019; Zhai et al., 2019). Phillips (2015) suggested that it is helpful to use SAMR in conjunction with another framework, such as TPACK, to help design the lesson and then evaluate the effectiveness of the technology integration of the lesson. Once teachers have experience with integrating instructional technology in their classrooms, they tend to integrate it at different SAMR levels.

The SAMR model is comprised of four levels - Substitution, Augmentation, Modification, Redefinition - that help teachers recognize on which level their designed learning task falls (Puentedura, 2006). The SAMR model is an effective way for in-service teachers to evaluate learning tasks and reflect on how they could have possibly moved from substitution to redefinition of their lesson (Geer et al., 2017; Romrell et al., 2014). Nkonki and Ntlabathi (2016) utilized SAMR to evaluate teachers' effectiveness of using Blackboard - a Learning Management System (LMS) - as a form and function of teaching and learning innovations at an institution of higher education. They concluded that many of the Blackboard innovations were superficial in nature and landed at the levels of Substitution and Augmentation. Their study used SAMR as the lens through which they identified the level of technology integration within the Blackboard LMS, but there was no indication of the participants' a priori level of technology integration ability in terms of their beginning perceived ease of use or perceived usefulness prior to Blackboard utilization. In this study, the SAMR model was used as a critical lens through which to evaluate the level each designed learning task belongs as they are connected to teachers' self-efficacy and self-reported perceived ease of use and perceived usefulness as measured by the TAM 2.

Statement of the Problem and Research Questions

This study's aim was to determine the relationship between in-service teachers' self-efficacy with perceived ease of use and perceived usefulness of instructional technology use and the level of its integration in lesson plans as measured by the SAMR model. The following research questions are the foundation to this study:

RQ1: Do differences in in-service teachers' self-reported self-efficacy levels connect to the different SAMR scores obtained from teachers' lesson plans that have instructional technology embedded in them?

RQ2: Do in-service teachers' perceived usefulness of instructional technology affect the SAMR outcome scores of integrating technology into their lesson plans?

RQ3: Do differences in SAMR score outcomes connect to differences in in-service teachers' perceived ease of use scores?

Definition of Terms

It is important that the specific terms used for the focus of this study are defined to provide a consistent understanding throughout this paper. The fundamental terms for this study that need defined include perceived ease of us, perceived usefulness, and self-efficacy. The instructional technology frameworks, TPACK and the SAMR model, need to be defined as well.

Perceived ease of use - user's perception of how much effort it takes to use the technology (Venkatesh & Davis, 2000)

Perceived usefulness - belief that a certain technology will help a person efficiently and effectively perform a job-related task (Davis et al., 1989)

SAMR model - a framework for teachers, comprised of four levels - Substitution, Augmentation, Modification, and Redefinition, used to evaluate the level of technology integration, developed by Ruben Puentedura (2006)

Self-efficacy - belief in one's own ability to accomplish a task (Bandura, 1994)

Technological, Pedagogical, and Content Knowledge (TPACK) model - an instructional framework, developed by Mishra and Koehler (2006), that gives teachers a way to think about how to effectively integrate instructional technology into lessons

Conclusion

This chapter discussed information about pre-service teachers and data about perceived ease of use and perceived usefulness which predicted future technology integration. The literature has an abundance of information on perceived ease of use, perceived usefulness, and self-efficacy for pre-service teachers, but this study will investigate in-service teachers (Asing-Cashman et al., 2014; Lee & Lee, 2014; Aypay et al., 2012; Keser et al., 2015; Shittu et al., 2016; Tondeur et al., 2012; Ünal et al., 2017). Research was identified, though not to the depth of pre-service teachers, that illustrated in-service teachers' integration of technology and their approach to using technology but did not include an evaluative measure (Adegbenro et al., 2017; Fokides, 2017; Pan & Franklin, 2011; Williams, 2017). It also recognized that teachers who utilized frameworks such as TPACK and SAMR for lesson planning were more productive in their efforts to integrate instructional technology. This study will add to the literature by evaluating lesson plans through the SAMR lens to determine the level in-service teachers are integrating technology into their lessons in relation to their self-reported TAM 2 perceived ease of use and perceived usefulness scores and self-efficacy scores.

Chapter 2: Literature Review

This chapter will review the literature regarding instructional technology integrative practices by both pre-service and in-service teachers. By reviewing both groups of teachers, the review will show the extent of literature known for pre-service teachers and the gaps in literature for in-service teachers. The focus will be on the role self-efficacy plays in instructional technology integration, how lesson planning with integrating technology in mind enhances instructional practice, the levels of acceptance of integrating instructional technology by teachers, and SAMR (Substitution, Augmentation, Modification, Redefinition) as a measurement outcome for instructional technology integration in teachers' lesson plans.

Self-Efficacy

Teachers tend to integrate instructional technology into their classroom when they perceive high levels of self-efficacy with regards to instructional technology (Livingstone, 2012; Sang et al., 2010; Tunkler et al., 2016). Teachers' beliefs in their self-efficacy to promote learning affect the types of learning environments they create (Bandura, 1993). Albert Bandura developed the Self-Efficacy Theory (1977) to help explain and predict human behavioral change. This component of Bandura's Social Cognitive Theory is defined as the belief in one's own ability to accomplish a task (Bandura, 1994). People who have high self-efficacy willingly participate in tasks they believe they can complete and those with low self-efficacy avoid tasks they deem too difficult. Bandura (1977) recognized that efficacious people usually expend more effort and persist longer when faced with challenges than those with low self-efficacy. Because increased self-efficacy leads to lower levels of anxiety, those who have a stronger self-efficacy will have lower levels of anxiety and will enact better coping efforts to persist in the task at hand (Bandura & Adams, 1977). For teachers, that task is effectively integrating instructional technology.

Self-efficacy beliefs guide the lives of people and determine how they feel, think, motivate themselves and behave (Artino, 2012; Bandura, 1977; 1982; 1994). Bandura (1986) determined that the outcome expectation is a consequence of an act or a behavior and people see these outcomes as a reflection of their performance. Therefore, people rely on their self-efficacy beliefs in deciding which course of action to take (Bandura, 1986). A chosen action is shaped in thought before enacted and a person's self-efficacy beliefs influence how he/she believes the course of action will play out (Bandura, 1993). To stay focused on the task at hand when working within demanding and stressful environments, like teaching environments, requires a strong sense of self-efficacy (Bandura, 1993).

Bandura (1993) postulated that there is a difference between having knowledge and skills and being able to utilize them in stressful situations. Furthermore, Bandura (1993) believed that people with the same set of skills and knowledge may perform an act or behavior differently depending on their self-efficacy thinking and classroom atmospheres are partly determined by a teacher's beliefs in his or her instructional efficacy. In order to support the increase of positive self-efficacy beliefs with regard to integrating instructional technology, teachers need successful mastery experiences and strong examples construed via social models (Bandura, 1994). Teachers need to believe that they can be successful in integrating instructional technology into their daily practices. In the next sections, the literature will show how pre-service and in-service teachers are given opportunities to increase their self-efficacy beliefs in connection with effectively integrating instructional technology into their lessons.

Pre-service Teachers' Self-efficacy and Technology Skills

Pre-service teachers need content specific practice, mastery experiences, and lesson design intervention during education coursework to increase self-efficacy of using instructional technology (Kilpatrick et al., 2014; Lee & Lee, 2014; Moore-Hayes, 2011; Sahin et al., 2013; Spiegel, 2002; Ünal et al., 2017). Lee and Lee (2014) found that by having pre-service teachers plan lessons using the TPACK (Technological, Pedagogical,and Content Knowledge) framework, teachers were able to focus on connecting and integrating technology effectively with their pedagogy and content. Mirzajani et al. (2015) recognize that a lack of self-efficacy is a key barrier to utilizing instructional technology in pre-service teachers' education courses. Ünal et al. (2017) showed evidence that a teaching practice course increased the TISE (Technology Integration Self-Efficacy) of pre-service teachers.

Increased self-efficacy has been shown to lead to increased use of instructional technology in the classroom (Asing-Cashman et al., 2014; Aslan & Zhu, 2015; Elstad & Christophersen, 2017; Kalemoglu Varol, 2014; Perkmen & Pamuk, 2011; Sadaf et al., 2016; Sang et al., 2010; Shittu et al., 2016). It has been noted that pre-service teachers, while confident in using technology, exhibit low self-efficacy levels in effectively selecting instructional technology to implement for dynamic teaching and learning (Kent

& Giles, 2017; Moore-Hayes, 2011). Pre-service teachers are comfortable using technology for social activities but are uncomfortable with selecting and using specific instructional technology for teaching and learning and in need of the opportunity to exhibit positive self-efficacy of using instructional technology for teaching and learning through applied practice (Li et al., 2015; Nadelson et al., 2013; Teo, 2009a; Tunkler et al., 2016). Raphael and Mtebe (2017) found that when pre-service teachers' self-efficacy beliefs are increased, these teachers will likely make better pedagogical decisions and integrate technology into their future classrooms. It is evident that utilizing instructional technology effectively is not about the amount and type of technology used, but by how and why it is used (Bose, 2010; Livingstone, 2012). Much of this research highlights whether or not levels of self-efficacy illustrate if pre-service teachers will integrate instructional technology in their future classrooms. What about in-service teachers with different levels of self-efficacy in regard to integrating technology? Do they follow through and integrate?

In-service Teachers' Self-efficacy and Technology Skills

Moore-Hayes (2011) found that there were no significant differences between pre- and in-service teachers concerning preparedness to integrate technology into daily teaching, and, specifically, in-service teachers felt they lacked the ability to select and evaluate technology to support teaching and learning resulting in low self-efficacy levels. These in-service teachers felt they would benefit from regular professional development opportunities utilizing current approaches to teaching with technology as well as the need to observe and participate in best practice integration models. Many current in-service teachers did not have the opportunity to learn via instructional technology when they completed their education courses; therefore, K-12 school districts need to be vigilant in preparing these teachers to use instructional technology for teaching and learning. Technology integration efforts should be creatively designed for specific content area ideas in a specific classroom context (Kilpatrick et al., 2014; Koehler & Mishra, 2009).

Kilpatrick et al. (2014) and Kim et al. (2013) have posited that it is important to consider teachers' pedagogic styles, beliefs, and self-efficacy levels with computers and technology when expecting them to implement instructional technology to support teaching and learning. Palak & Walls (2009) found that even in schools where there is an abundance of technology, many teachers continue to integrate technology in ways that support already existing teacher-centered practices. Likewise, a study by Ertmer (2005) evidenced that teachers will adopt technology without changing their pedagogy. In contrast, Lai (2005) showed that the higher the level of self-efficacy of teachers, the more willing they are to experiment with new methods of teaching, they are more persistent and have higher resilience. This implies the need to focus on increasing the level of self-efficacy of in-service teachers to observe possible changes in their pedagogical practices.

Support from administration of in-service teachers is needed for continued integration of technology in conjunction with continued targeted professional development (Pan & Franklin, 2011). Furthermore, Pan & Franklin (2011) believe that with administrative support and targeted professional development, self-efficacy levels will increase, and these high self-efficacy levels consistently predict the future use of web 2.0 tools. True integration of technology will happen when teachers expand their knowledge of pedagogical practices across multiple aspects of the planning, implementation, and evaluation processes (Ertmer & Ottenbreit-Leftwich, 2010; Kalogiannakis, 2010). Teachers need strong self-efficacy to appropriately teach with technology and the more content-specific the example, the more likely teachers will see the value and learn it (Ertmer & Ottenbreit-Leftwich, 2010). This means that in-service teachers need the opportunity to attend professional development targeted to them and need positive experiences using the technology during implementation so that they may change their beliefs and begin to utilize more technology in their classrooms (Davis & Eslinger, 2001; Ertmer & Ottenbreit-Leftwich, 2010; Hsu, 2016; Türel, 2014).

In-service teachers need to understand the connection between pedagogy infused with instructional technology and Yu and Okojie (2017) investigated this perceived understanding and found that teachers needed help integrating their technology into daily lessons. Similarly, teachers who learn technology from a content area perspective are more likely to use it to support their content and that developing technology-supported pedagogy is reliant on the teachers' interpretation of the value of the technology for teaching and learning (Hughes, 2005). Hsu (2016) examined the current beliefs and practices concerning instructional technology of K-6 teachers and observed that those who had high self-efficacy beliefs about technology were more likely to hold constructivist pedagogical beliefs as well. However, it may not hold true that just because a teacher exhibits student-centered pedagogical beliefs that they will ultimately integrate technology. One study produced evidence where teachers who held strong student-centered beliefs did so in spite of using technology, but other teachers' low-level technology beliefs were the strongest barrier to technology integration in the same school (Ertmer et al., 2012).

The literature on self-efficacy shows that both pre-service and in-service teachers who have higher levels of self-efficacy are more willing to integrate technology into their K-12 curriculum. Kiili et al. (2016) developed a survey instrument to measure self-efficacy in three different areas: computer self-efficacy, teaching self-efficacy and self-efficacy towards technology integration. Their intervention study compared pre-service teachers' self-reported self-efficacy scores pre- and post- a digital composition course during one semester of their teacher education program (Kiili, et al., 2016). Though this is a relatively new instrument, the authors showed clinical utility of the instrument to identify pre-service teachers with low self-efficacy levels. Compared to other self-efficacy instruments used for self-efficacy measures, this instrument was chosen because it focused on self-efficacy towards technology integration. For this study, this instrument will be used to compare in-service teachers perceived self-efficacy levels with their SAMR score outcomes.

Lesson Planning with Integrating Technology in Mind

As previously mentioned, teachers' beliefs in their self-efficacy to utilize technology to support teaching and learning affect the learning environments they create, and the task of creating these learning environments that are conducive to learning relies heavily on the ability and self-efficacy of in-service teachers (Bandura, 1993). Bandura (1993) believes that teachers choose tasks which result in successful outcomes even at the detriment of expanding one's competencies, but, if they gain progressive mastery, they will increase their self-efficacy. Teachers could benefit from utilizing technology integration frameworks, like TPACK, where Lee and Tsai (2010) concluded that there are significant correlations between self-efficacy and positive attitudes towards web-based instruction and those with higher self-efficacy tended to utilize web-based instruction more.

TPACK (see Figure 2) is a technology integration framework that many instructional technology integrationists and educators utilize to help with effective instructional technology integration and planning (Mishra & Koehler, 2006). It is important for teachers, pre- or in-service, to understand the instructional design process and, with the onset of integrating technology, to incorporate a procedural way to consistently plan, implement and evaluate the effectiveness of daily lessons (Summerville & Reid-Griffin, 2008). Teachers need a clear vision of how integrating technology into their classroom instruction can, and will, improve teaching and learning; therefore, teachers need to understand how to appropriately design a lesson where technology is effectively incorporated (Ertmer, 1999; Livingstone, 2012).

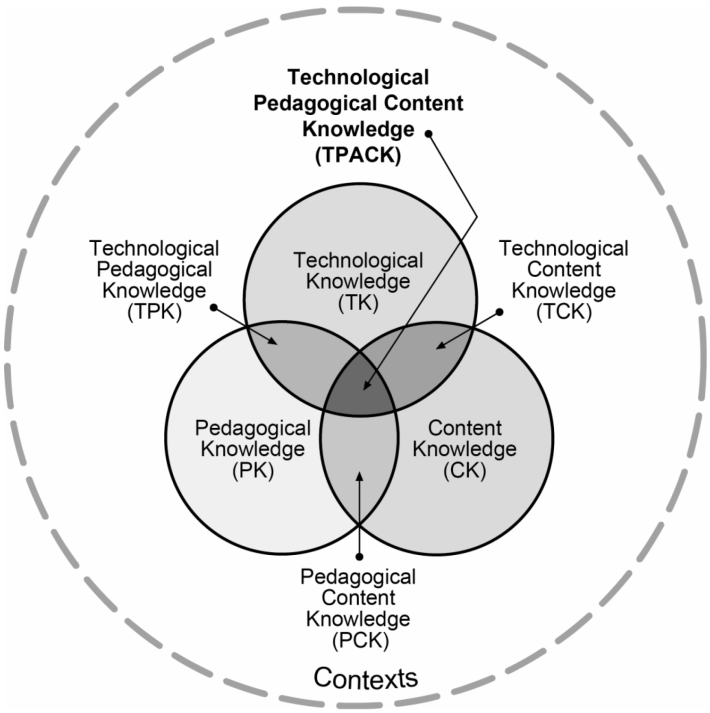

Figure 2. TPACK Framework. Reproduced by permission of the publisher, © 2012 by tpack.org

Technological Knowledge (TK), Pedagogical Knowledge (PK), and Content Knowledge (CK), or TPACK, is a technology integration framework based on Shulman's PCK (1986) and developed by Mishra and Koehler (2006) that is used to visualize and categorize effective integration of instructional technology (Green, 2014). TPACK is an analytical lens from which to view instructional decisions made by teachers and places emphasis on pedagogy over technology (Green, 2014). By examining pedagogically sound ways to implement and plan for instructional technology integration at the intersection of all three components, TK, PK, and CK, teaching and learning are supported (Kihoza et al., 2016).

The development of TPACK knowledge by teachers is critical for effective teaching with technology and it produces the flexible knowledge needed to successfully integrate technology into each learning task, especially those that are already strong pedagogically and content specific (Bilici et al., 2013; Hilton, 2016; Koehler & Mishra, 2009). Koehler and Mishra (2009) and Khan (2014) believe that if teachers understand the affordances of different technology, it will help them to make better decisions and school districts will enact better professional development targeted to their teachers' needs. The in-service teachers in this study have been exposed to TPACK through various professional development opportunities and are familiar with the concept but many have not been formally trained on its use and implications of designing effective integrative technology-enhanced lessons.

For beginning teachers, it is important their education programs provided opportunities for learning technology integration within the TPACK framework, received hands-on learning experiences, and applied practice throughout their coursework (Aslan & Zhu, 2015; Mouza et al., 2014; Pamuk, 2012). Tozkoparam et al. (2015) and Chai et al. (2010) conducted studies where pre-service teachers' TPACK competencies were measured pre- and post- an ITMD (Instructional Technology and Material Design) course and ICT (Information and Communication Technology) course respectively. Results from both studies indicated a positive increase in participants' TPACK ability and the provision of experiential learning of pedagogical approaches was effective for raising TK and PK. Other studies have indicated that pre-service teacher self-efficacy levels with regards to technology integration predicted TPACK competencies of pre-service teachers and specific knowledge of the intersections between TK and CK support higher self-efficacy beliefs (Abbitt, 2011; Keser et al., 2015). By building a solid base in TPACK competencies as pre-service teachers, the hope is that these teachers will continue to design effective technologically integrative lessons as they transition into the role of in-service teachers.

The TAM 2 and Teacher Level of Acceptance of Instructional Technology

Perhaps the best way to predict if pre-service or in-service teachers will use instructional technology in their classrooms and what factors, if any, help or hinder their effective use of technology is to use the Technology Acceptance Model, or TAM (Davis et al., 1989). The Technology Acceptance Model (see Figure 3) was developed by Davis (1985) to find a way to determine the reasons whether a user of a certain technology system used it or not. Davis (1985) based his model on the Theory of

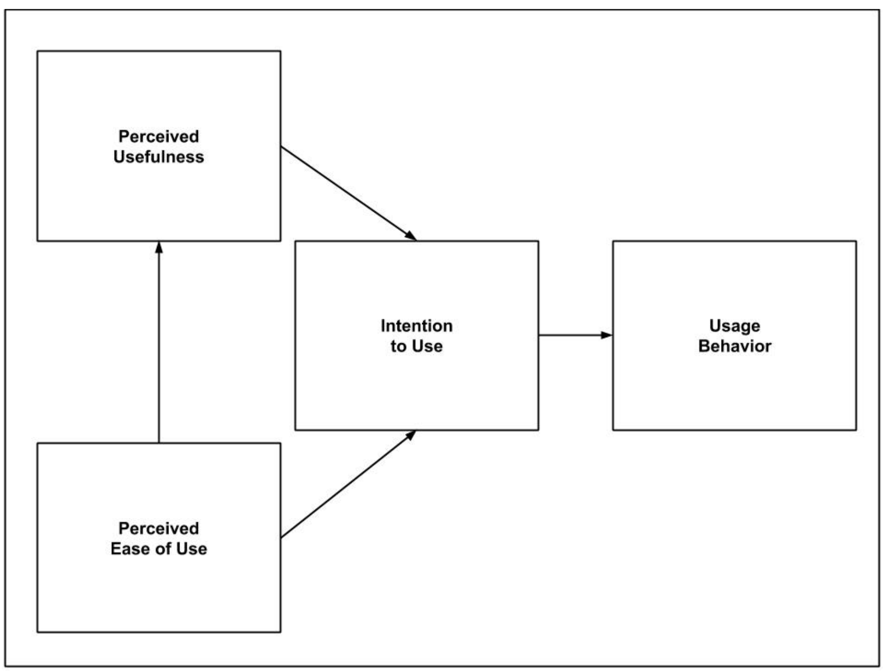

Figure 3. Original Technology Acceptance Model. Adapted with permission, Venkatesh & Davis, A theoretical extension of the technology acceptance model: Four longitudinal field studies, *Management Science, 46*, 2, February 2000. Copyright (2015), the Institute for Operations Research and the Management Sciences, 5521 Research Park Drive, Suite 200, Catonsville, MD 21228 USA.

Reasoned Action (TRA), developed by Fishbein and Ajzen (1975), which attempts to understand one's intention to behave a certain way and predict if they will follow through on the behavior. One element of the TRA model that Davis decided not to include in the TAM model was the subjective norm. He asserted that the subjective norm had no significant effect on intentions and did not hold an influence any more than perceived usefulness or perceived ease of use (Davis et al., 1989; Venkatesh & Davis, 2000). The TRA model was more generic and could be used in many different fields and with many different topics, but Davis narrowed the field for TAM, which focuses on predicting technology use (Davis et al., 1989; Wu et al., 2011).

Teo (2009b) found that TAM can explain user behavior across a broad range of technologies and contexts and the perceived ease of use and perceived usefulness of the technologies. TAM became one of the first empirically proven models to include psychological factors - perceived ease of use and perceived usefulness - that affect a user's acceptance of technology (Teo, 2009b). "Numerous empirical studies have found that TAM consistently explains a substantial portion of the variance (typically about 40%) in usage intentions and behavior, and that TAM compares favorably with alternative models such as the Theory of Reasoned Action (TRA) and the Theory of Planned Behavior (TPB)" (Venkatesh & Davis, 2000, p. 186). Davis et al. (1989) determined that the variables perceived ease of use and perceived usefulness were directly and indirectly associated with a user's behavioral intention to use a certain technology. Perceived usefulness is how much a person believes a certain technology will help him/her efficiently and effectively perform a job-related task and perceived ease of use is the extent to which the user believes it will take minimal effort to utilize the technology (Davis et al., 1989; Teo, 2009b).

Davis (1989) used Bandura's research on self-efficacy to support the importance of perceived ease of use and perceived usefulness as basic determinants of user behavior. Bandura (1982) believed that human behavior is predicted by both self-efficacy and outcome judgments and Chutter (2009) believed there is a link between self-efficacy and perceived ease of use and outcome judgments and perceived usefulness. In multiple studies, it has been observed that TAM is a credible option and empirically proven to predict the intention, acceptance, and perceptions of usability and self-efficacy of pre-service and in-service teachers to use technology and how they develop pedagogical intention to use technology in their future classrooms (Asing-Cashman et al., 2014; Fokides, 2017; Teo, 2009b, Wu et al., 2011; Yucel & Gulbahar, 2013).

Venkatesh and Bala (2008) state that "perceived ease of use has been theorized to be closely associated with individual's self-efficacy beliefs and procedural knowledge, which requires hands-on experience and execution of skills" (p. 279). It has been noted by Wangpipatwong et al. (2008) that computer self-efficacy directly enhanced the intention to continue using a technology; furthermore, the author discovered that while TAM's purpose is to explain a user's initial intention to adopt a technology, it can also be employed to predict a user's intention to use the technology even after having a long period of interaction with it. This implies that personal experiences with technology may help or hinder their progress with using, or continuing to use, technology.

Venkatesh and Davis (2000) and Wingo et al. (2017) also found that self-efficacy in computer use significantly affected perceived ease of use before and after users were exposed to a system of technology. One study utilized TAM to measure in-service teachers' perceived usability and self-efficacy towards the current instructional technology they are integrating and found that teachers' self-efficacy in using technology, which directly influenced perceived ease of use and usability, was more beneficial than just computer self-efficacy (Holden & Rada, 2011). For teachers using instructional technology, perceived usefulness is the strongest predictor, or determinant, of the intention of teachers to continue using the instructional technology (Aypay et al., 2012; Teo, 2009b; Tozkoparam et al., 2015; Wangpipatwong et al., 2008). With the continuing changes and innovation in educational technology, teachers are extremely important to the implementation of effective technology use and are expected to keep up with these changes (Teo, 2009).

Venkatesh and Davis (2000) revisited the TAM and decided to extend the TAM, known as the TAM 2 (see Figure 4) to explore how variables affect the key determinants - perceived usefulness and perceived ease of use - in terms of social influences (subjective norm, voluntariness, image) and cognitive instrumental processes (job relevance, output quality, results demonstrability, perceived ease of use). After testing the TAM 2, it was found that both social influences and the cognitive instrumental processes significantly influenced user acceptance which could help inform future research on how users adopt and utilize technology (Venkatesh & Davis, 2000). The TAM 2 will be used in this study instead of the TAM because of the added social and cognitive instrumental processes.

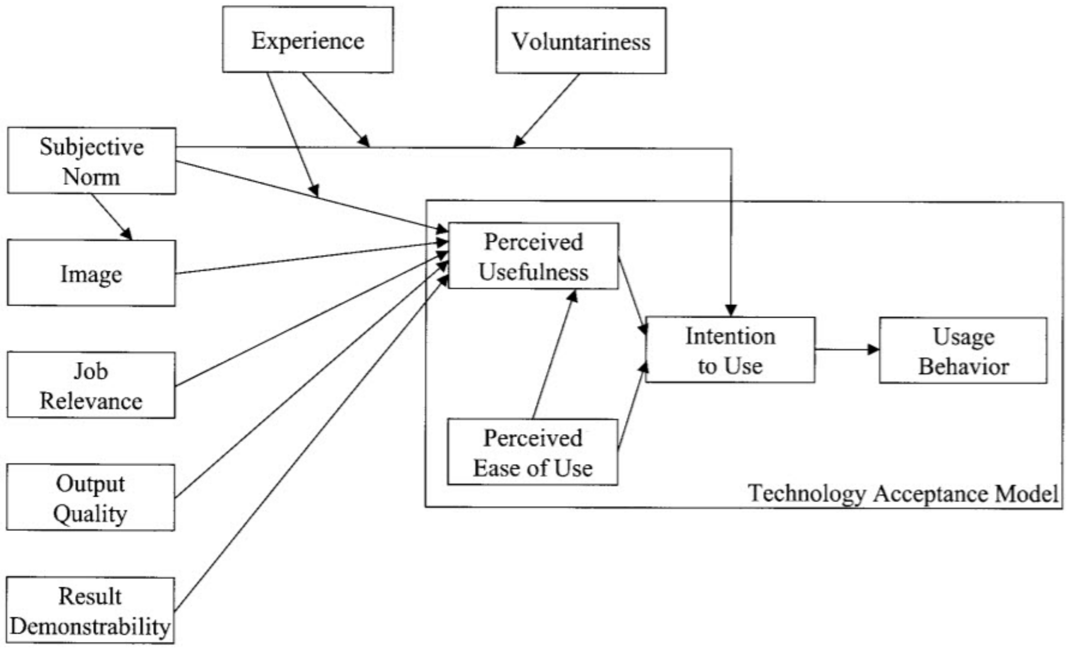

Figure 4. Technology Acceptance Model 2 (TAM 2) shown with the social processes and cognitive instrumental processes. Adapted with permission, Venkatesh & Davis, A theoretical extension of the technology acceptance model: Four longitudinal field studies, *Management Science, 46*, 2, February 2000. Copyright (2015), the Institute for Operations Research and the Management Sciences, 5521 Research Park Drive, Suite 200, Catonsville, MD 21228 USA.

The social influence processes include subjective norm, voluntariness, and image. Subjective norm was revisited and included in TAM 2 because it is believed that a person may choose to perform a behavior if they think that others that they deem important think they should even if they would not be in favor of the behavior (Venkatesh & Davis, 2000). Park (2009) stated that the “subjective norm, one of the social influence variables, refers to the perceived social pressure to perform or not perform the behavior” (p. 152). Voluntariness is identified as a moderating variable as to distinguish between mandatory and voluntary use of technology and the potential users of the technology perceive the use as non-mandatory (Wu et al., 2011). The image variable reflects the group mentality where one believes a certain behavior is necessary to stay favorable in the eyes of a social group important to the individual (Venkatesh & Davis, 2000; Wu et al., 2011).

The cognitive instrumental processes include job relevance, output quality, result demonstrability, and perceived ease of use. Job relevance refers to the perception a user has about how applicable a technology is to his/her job. Output quality is perceived by the user if the task a technology can do matches the user's job goals (Venkatesh & Davis, 2000). If positive results are easily recognized from using the technology, then the result demonstrability of using it will be more positively perceived by the user (Wu et al., 2011). Lastly, perceived ease of use, a direct determinant of perceived usefulness, is derived from the user's perception of how much effort it takes to use the technology and increases job performance (Venkatesh & Davis, 2000).

Venkatesh and Bala (2008) updated the TAM 2 with anchors and adjustments to perceived ease of use and perceived usefulness in this new TAM 3. Venkatesh and Bala (2008) posited three new relationships using the moderator of experience with a technology. TAM 3 values a user's experience with a technology and how the effects of "anchors" identified by Venkatesh and Bala (2008), such as computer self-efficacy and computer anxiety, may diminish over time as the user gains more hands-on experience with the technology. This study is not looking for the effects of experience on the relationships of perceived ease of use, perceived usefulness, or computer self-efficacy. The TAM 2 remains a better fit for this study to measure overall technology acceptance and behavioral intention and use these self-reported scores to compare with outcome measures using the SAMR model.

Bandura (1982) studied the importance of perceived usefulness and perceived ease of use in predicting behavior and proposed that behavior is best predicted by both self-efficacy and outcome judgments. Chuttur (2009) expands on Bandura's work by defining self-efficacy (perceived ease of use) as "judgments of how well one can execute a course of action required to deal with prospective situations" (p. 4) and outcome judgments (perceived usefulness) as "the extent to which a behavior once successfully executed is believed to be linked to valued outcomes" (p. 4). This implies, in regard to this study, that in-service teachers' self-reported TAM 2 measures will show that those who have a high perceived ease of use and perceived usefulness scores should integrate technology into their lessons at a higher SAMR level.

Venkatesh and Davis (2000) hypothesized that social influence processes affecting perceived usefulness and intention to use will decrease over time as users become more experienced with the technology. Hamdani (2019) discovered that through the use of the TAM 2 to explain voluntary and compulsory use of technology, evidence suggested that as people gain more usage experience over time with technology, their perceptions of its usefulness and attitude towards it will change. This was also confirmed by Wingo et al. (2017) in which faculty who taught online adapted to teaching in an online environment as they gained more experience over time and correlations were found between faculty's self-efficacy and their willingness to continue to teach online. By understanding a teaching staff's computer self-efficacy, better professional development can be planned and aligned to the needs of the staff in the hopes of implementing better technology integration (Wingo et al., (2017).

In this study, once the in-service teachers' self-reported TAM 2 scores are obtained, it is important to find out if they followed through and integrated technology into their lessons. To evaluate the level to which these teachers integrated technology into their lessons, the SAMR model will be utilized as the critical lens for review of their integrated technology.

SAMR as a Measurement Outcome of Technology Integration in Lesson Plans

As previously noted, measuring TPACK is a great way to determine competency but it does not explain why teachers integrate technology differently. The SAMR model provides teachers a way to evaluate their learning tasks in which they incorporated technology (Phillips, 2015). The SAMR model, developed by Puentedura (2006), is an instructional technology integration framework that assists with evaluating each learning task and a tool for helping educators to enhance and transform the quality of education via technology (Romrell et al., 2014). SAMR is an acronym that stands for Substitution, Augmentation, Modification, and Redefinition.

The Substitution level is technology used as a direct tool substitute with no functional change. For example, a teacher may have students use Google Docs to type a paper instead of writing with pencil and paper. The Augmentation level is technology used as a direct tool substitute with functional improvement. The same teacher may have students share their Google Docs with other students and then use the comment feature to give each other feedback in real-time. Both the Substitution and Augmentation levels are considered part of the enhancement stage of the SAMR model.

The Modification level is when technology is used to create an entirely new task design. In keeping with the example, the teacher may ask students to then include self-created multimedia clips in the Google Doc to make it interactive. The Redefinition level is when technology is used for the creation of new tasks previously inconceivable without technology. After students complete their interactive Google Doc, they can find students in a class in another region of the United States and work together to collaborate on the Google Doc or gain feedback on their finished product from an authentic audience. Both the Modification and Redefinition levels are considered the transformation stage of learning experiences (Puentedura, 2006).

Romrell et al. (2014) used the SAMR model to review current research that utilized mLearning activities and found SAMR to be an effective evaluative tool. Findings indicated that the SAMR model could assist instructional designers with developing exceptional transformative learning experiences (Romrell et al., 2014). Similarly, Hilton (2016) conducted a case study of two social studies teachers using the SAMR model throughout one school year which resulted in SAMR being identified as an effective reflective tool and a way to evaluate each learning task's depth and complexity. Results from these studies indicated that SAMR, in its graphical representation, looks hierarchical but should not be viewed as such even though the idea of SAMR is to describe technology integration at different levels (Hilton, 2016; Romrell et al., 2014). Another study used SAMR to evaluate the impact of iPads on possible changes in pedagogy and it was realized that increases occurred in collaboration and communication, but many teachers remained in the enhancement phase of SAMR (Geer et al., 2017).

A strong professional development program in a school district can assist with effective instructional technology integration and teachers progressing towards using technology for teaching and learning. Teachers utilizing technology require timely support and follow-up, time to prepare lessons effectively using technology, and adequate training opportunities - leaving behind ineffective stand-alone workshops (Howell et al., 2014; Ulsu, & Bumen, Geer et al., 2017). These professional development opportunities need to be structured in a way that increases teacher confidence with instructional technology and builds on teacher self-efficacy in the use of digital tools with contextualized support (Kilpatrick et al., 2014). A strong and structured professional development program can assist teachers in moving from the enhancement phase of SAMR to the transformation phase as indicated by a study following the use of SAMR in a 1:1 iPad school (Geer et al., 2017). Through this study, it is evident that schools with more structured professional development had more teachers in the transformation stage than those without as much structured professional development (Geer et al., 2017). It is the hope of this study to determine if in-service teachers' self-reported TAM 2 measures and self-reported self-efficacy levels are connected to levels of integrated technology use as viewed through the SAMR model levels identified in the teachers' lesson plans.

Chapter 3: Methodology

This study was designed to gather perceived ease of use, perceived usefulness, and self-efficacy data from in-service teachers on their use of instructional technology in their lesson plans. In-service teachers from a public K-12 school district in the northeastern United States were asked to upload a sample lesson plan and complete a questionnaire that includes 32 total questions. The questions were designed to measure demographic information and perceived ease of use, perceived usefulness, and self-efficacy of integrating instructional technology into lesson plans.

Research Design and Questions

The study took place at a public school district in the northeast United States. Over the past five years, teachers in this district have had the opportunity to receive ongoing professional development (PD) from instructional technology coaches. These instructional technology coaches are certified district teachers and have special knowledge and skills of how to integrate technology into the school board approved curriculum. The previous chapter discussed the input phase of instructing the teachers on how to use technology but did not show a preponderance of literature that discussed how the teacher-created lessons changed as a result of the ongoing PD sessions. The literature also discussed the SAMR model from Puentedura (2006) as a framework to measure the degree of technology integration into lesson plans used in the K-12 classroom which leads to a quantitative, non-parametric exploratory design. This is a non-parametric study because the participants were not selected randomly. The following research questions were addressed by this study:

RQ1: Do differences in in-service teachers' self-reported self-efficacy levels connect to the different SAMR scores obtained from teachers' lesson plans that have instructional technology embedded in them?

RQ2: Do in-service teachers' perceived usefulness of instructional technology affect the SAMR outcome scores of integrating technology into their lesson plans?

RQ3: Do differences in SAMR score outcomes connect to differences in in-service teachers' perceived ease of use scores?

Participants

The participants for this study were from a public, suburban K-12 school district located in the northeastern region of the United States. The district is made up of twelve school buildings - one senior high school, one intermediate high school, three middle schools, and seven elementary schools. All current 696 in-service teachers were given the opportunity to participate in this study regardless of grade level taught or area of certification. Since this district began a 1:1 initiative five years ago, these participants have begun to integrate technology into lesson plans.

Procedures

The researcher obtained Institutional Review Board (IRB) approval for the study. Additionally, in accordance with district protocol, a request was made to the Assistant Superintendent of the school district asking that a scripted email (see Appendix A) be sent to the principal of each building in the district. The principal then sent the scripted email out to all in-service teachers in their respective buildings.

This email detailed the reason and purpose of the study. Within the email, a link was included for each participant to access the electronic questionnaire for the study. On the first page of the questionnaire was the informed consent (see Appendix B) for the study. If the participant gives their consent to participate, they will proceed to the first question. If they do not consent, the participant is exited from the questionnaire. If at any time a participant wants to end their participation prior to completing the questionnaire, he/she can exit the questionnaire. Incomplete data will never be sent to the researcher. The questionnaire for this study was opened for two weeks and a follow-up email was sent to all possible participants in the district as a reminder to complete the questionnaire in the last week.

Data Collection

The researcher collected participant responses via a Qualtrics questionnaire that compiled anonymous responses for data analysis. The Qualtrics survey platform uses Transport Layer Security encryption (TLS), also known as HTTPS, to protect data and IP addresses are masked ("Security Statement," 2020). All collected data was kept in the researcher's password-protected Duquesne University's Qualtrics account. Data was analyzed using IBM Statistical Packages for Social Sciences (SPSS) 26 (IBM Corp., 2019) on the researcher's password-protected Windows 10 personal computer (PC).

In addition to the questionnaire responses, participants were asked to upload a sample lesson plan during the Qualtrics questionnaire. To maintain the anonymity of the participants, a third party reviewed the submitted lesson plans to look for any identifying information. This third-party reviewer removed any identifying data from the lesson plan and re-submitted the lesson plan prior to the researcher analyzing the lessons. The researcher did not collect any identifying information from the participants. Building names, participant names, IP addresses, activities in lessons, and any other identifying information was not collected; however, in the event that a participant indirectly identified him/herself, the third-party reviewer removed this information prior to the researcher looking at the data.

Instrument

The Qualtrics survey platform was used to collect participant responses to 32 questions that make up the questionnaire (see Appendix C). The first 5 questions gathered participant demographic information such as years teaching, content taught, grade level(s) taught, frequency of technology integration in lesson plans, and from which college/university was his/her teaching certificate obtained.

The next 16 questions were adapted, with permission, from Venkatesh and Davis' (2000) Technology Acceptance Model 2 (TAM 2) survey instrument and measured on a Likert 4-point scale where 1 is *strongly disagree* and 4 is *strongly agree*.

Venkatesh and Davis (2000) measured the reliability of TAM 2 survey questions at α > .80. Acarli and Saglam (2015) and Kushatmaja and Suryani (2019) also tested for reliability and determined Cronbach's Alpha (CA) > .75 and > .78 respectively. Ngangi and Santoso (2019) and Trakulmaykee and Benrit (2014) utilized Construct Reliability (CR) to test for reliability of the TAM 2 and determined CR > .88 and > .93. In both reliability measures, CR and CA, reliability results should be greater than .70. These reliability measures indicate a high reliability if the instrument produces consistent results under consistent conditions over time (Bashir et al., 2008).

The last 11 questions use the same Likert 4-point scale and were adapted, with permission, from a self-efficacy survey created and used by Kiili et al. (2016) to measure teacher self-efficacy, computer self-efficacy, and self-efficacy towards technology integration. Through a validation study conducted by the authors, the self-efficacy instrument was determined valid after using the instrument with 200 participants to measure their self-efficacy. The three topics (teacher self-efficacy, computer self-efficacy, and self-efficacy towards technology integration) "were chosen to test whether they would prove to be separate constructs of potential value for understanding the role of self-efficacy when working in a range of increasingly digitalized educational environments" (Kiili et al., 2016, p. 10).

Kiili et al. (2016) indicated validity of the instrument to be acceptable with parameter estimates statistically significant ($p < .001$). Fit indices are noted as such: the Root Mean Square Error of Approximation (RMSEA) = .06 where the RMSEA cut off is < .08; the Comparative Fit Index (CFI) = .98 which is above the cut-off of .95; the Tucker Lewis index (TLI) = .97 which is above the cut-off of .95; and a 90% confidence interval

(CI) = .030, .082. The authors also measured the reliability of the self-efficacy instrument for each of the question sets separately. For the self-efficacy towards technology integration questions at α = .93, computer self-efficacy questions at α = .89, and teacher self-efficacy questions at α = .84 (Kiili et al., 2016).

In a second study, Kiili et al. (2016) used the self-efficacy survey for an intervention study with 38 participants. Participants in this study responded to the self-efficacy survey before and after taking a course on digital literacies and learning in digital environments during their pre-service education program. Results from the intervention study indicated that the survey instrument would be reliable to inform professional development decisions, identify teachers' self-efficacy levels, and highlight the types of support needed to increase self-efficacy levels in all three areas - computer, teacher, and technology integration.

The last portion of the questionnaire asked participants to upload a sample lesson plan for evaluation by the researcher. The researcher evaluated participant-submitted lesson plans and placed their technology use on a SAMR level. The SAMR rubric (see Appendix D) utilized to rank the level of technology integration used in each lesson plan is based on Puentedura's (2006) definitions of each level (Substitution = 1, Augmentation = 2, Modification = 3, Redefinition = 4). This rubric was tested for content validity by sending it to experts in the field who evaluated and validated the rubric. Once lesson plans were reviewed by the researcher, interrater reliability will be determined by having experts in the field rate the submitted lesson plans using the same SAMR rubric and compare those ratings to those of the researcher.

Variables

This study examined a) the degree to which in-service teachers' perceived usefulness (PU) of instructional technology affects the outcome of integrating technology into lessons and b) if differences in in-service teachers' self-reported perceived ease of use (PEU) and self-efficacy (SE) scores connect to differences in the level of SAMR scores obtained from teachers' lesson plans that have instructional technology embedded in them. The SAMR score determined by the researcher is the only dependent variable in this study. The other variables in this study are all independent. These independent variables, such as PEU, PU, SE, and demographic categories, will help the researcher to identify differences between groups' SAMR outcomes.

Data Analysis

SPSS 26 (IBM Corp., 2019) was used to analyze the data. Demographic data was analyzed using descriptive statistics and Chi-square tests. Spearman's rank-order correlation coefficient was used to identify relationships between two ranked variables (e.g. gender and SAMR score) and correlation coefficients to view the relationship between the other variables within the study. The differential statistics that were used was determined by the data collected. If there are enough participants, it will be possible to run a Kruskal-Wallis ANOVA for the combinations that can be made from the demographic data to look for differences in SAMR scores based on the other independent variables.

The researcher evaluated the level of technology integration in the submitted in-service teachers' lesson plans. The level of SAMR is the dependent variable. The independent variables - PU, PEU, and SE - will affect the dependent variable.

Chapter 4: Data Analysis and Results

The purpose of this study was to determine if the level of integration of technology into in-service teachers' lesson plans as measured by a SAMR rubric relates to self-reported self-efficacy, perceived ease of use and perceived usefulness as measured by the Technology Acceptance Model 2 (TAM 2) survey. In using the SAMR model as an evaluative tool, a comparison was made of the actual integration of instructional technology via teacher submitted lesson plans and participants' self-reported self-efficacy and TAM 2 selections.

By using the Technology Acceptance Model 2 (TAM 2) and Self-Efficacy as the basis of this study, survey responses were analyzed to see if in-service teachers' self-reported self-efficacy, perceived usefulness, and perceived ease of use scores impacted the level of technology use as shown on the SAMR (Substitution, Augmentation, Modification, Redefinition) scale.

Participants were in-service teachers from a single K-12 public school district in the northeastern United States. Participants represented all grade levels as observed in Table 1. The majority of participants taught at the secondary level. In Table 2, participants' content areas in which they currently teach are shown. The four core content areas of Math, Science, Social Studies, and English and Language Arts (ELA) were highly represented.

Table 1

Frequency of Grade Levels Taught by Participants

	Frequency	%
Grade Level		
Kindergarten	3	2.3
First	4	3.1
Second	8	6.1
Third	7	5.3
Fourth	9	6.9
Fifth	4	3.1
Sixth	13	9.9
Seventh	20	15.3
Eighth	15	11.5
Ninth	14	10.7
Tenth	12	9.2
Eleventh	11	8.4
Twelfth	11	8.4
Grade Band Totals		
Elementary (K-5)	35	26.7
Middle (6-8)	48	36.6
High (9-12)	48	36.6
Total Participants	131	100

Table 2

Frequency of Content Areas Taught by Participants

	Frequency	%
Content Area		
Business, Computer, & Information Technology	2	1.5
English & Language Arts	39	29.8
Fine Arts	10	7.6
Food & Consumer Sciences	3	2.3
Gifted	1	0.8
Health & Physical Education	13	9.9
Library	2	1.5
Math	20	15.3
Science	15	11.5
Social Studies/History	14	10.7
Special Education	4	3.1
World Language	8	6.1
Total Participants	131	100

Data were collected via an online questionnaire and participants' submitted lesson plans to answer the following research questions:

RQ1: Do differences in in-service teachers' self-reported self-efficacy levels connect to the different SAMR scores obtained from teachers' lesson plans that have instructional technology embedded in them?

RQ2: Do in-service teachers' perceived usefulness of instructional technology affect the SAMR outcome scores of integrating technology into their lesson plans?

RQ3: Do differences in SAMR score outcomes connect to differences in in-service teachers' perceived ease of use scores?

Of the 696 possible participants, 221 responses were returned giving a 31.8% response rate and an 18.8% valid response rate. The online questionnaire was open for two weeks and a total of 221 responses were obtained. Of those initial 221 responses, only 131 were considered valid. Invalid entries, those with incomplete data or without submitted lesson plans, totaling 90 entries, were omitted from the study results. Participants' questionnaire responses were analyzed and compared to the level of the SAMR scale on which their lesson plan fell. The researcher used the SAMR rubric (see Figure 5) to determine the instructional technology integration level that was observed for each lesson plan.

SAMR Level	SAMR Definition
Substitution	Technology acts as direct tool substitute, with no functional change
Augmentation	Technology acts as direct tool substitute, with functional improvement
Modification	Technology allows for significant task redesign
Redefinition	Technology allows for the creation of new tasks, previously inconceivable

Figure 5. SAMR rubric used to evaluate the level of each lesson plan.

Based on Chapter 3, each question on the questionnaire was initially measured on a 4-point Likert scale. In many instances during Chi-square analyses, data was not present in some of the categories due to participants' selections. The researcher changed the scale for all variables to display data in two groups rather than four. Strongly Agree and Agree choices were combined into one group, Agree, and Strongly Disagree and Disagree choices were combined into another group, Disagree. The rationale for making such a change was due to the lack of data present in some of the initial 4 Likert categories. Data was difficult to interpret in a Chi-square analysis with data missing out of some categories.

The dependent variable SAMR has 4 separate levels - S, A, M, and R. However, some levels were not represented in some questions and resulted in a count of 0 for lesson plans at the different levels of SAMR. Because data were missing out of categories for many questions, there were no significant relationships found between the independent variables and the dependent variable. For example, in Table 3, the question "In my job, technology integration is relevant" shows three 0's for S, M, and R categories for those that chose Strongly Disagree. The Chi-square results showed x^2= (9, *N* = 131) = 5.83, *p* = .757 with no statistical relationship between groups.

Table 3

Chi-square Results for Intention to Use Technology

In my job, technology integration is important.				
	SAMR Level			
	Substitution	Augmentation	Modification	Redefinition
Strongly Disagree	0	0	1	0
Disagree	3	7	2	1
Agree	14	32	25	8
Strongly Agree	7	20	8	3

*$p < .05$

After analyzing initial Chi-square data, the researcher determined there was not a definitive reason to keep Strongly Disagree and Disagree separate and by combining these categories into one - Disagree, data could be further analyzed using independent samples t-tests. In order to have comparable categories, the researcher made the same change to the Strongly Agree and Agree categories and combined these into one category - Agree.

Likewise, the dependent variable, SAMR, was changed from 4 levels to 2 levels based on Puentedura's (2006) combination of his 4 levels into 2 stages - transformation and enhancement stages. The Substitution (S) and the Augmentation (A) levels were viewed as the enhancement category and the Modification (M) and the Redefinition ® levels were viewed as the transformation category. This decision was made so the researcher could run the independent samples t-tests using the two groups/categories for the dependent variable.

RQ1: Do differences in in-service teachers' self-reported self-efficacy levels connect to the different SAMR scores obtained from teachers' lesson plans that have instructional technology embedded in them?

Self-efficacy responses were taken from 11 of the 32 questions in the online questionnaire. Table 4 displays descriptive statistics from participants' responses to the 11 self-efficacy questions. It is important to note that the question "I feel confident that I can develop my teaching" resulted in all participants selecting Agree. Since no one selected Disagree, calculations could not be completed without data in a second category leaving no information for the standard deviation (SD). Frequencies of SAMR outcomes related to self-efficacy selections by participants can be observed in Table 5.

Table 4

Self-Efficacy Level Descriptives

	N	Min	Max	M	SD
Teaching Self-Efficacy					
I feel confident that I can create meaningful learning experiences for my students.	131	1	2	1.97	.173
I feel confident that I can motivate my students to be actively involved in their learning.	131	1	2	1.99	.087
I feel confident that I can develop my teaching.[a]	131	2	2	2.00	
Computer Self-Efficacy					
I feel confident that I can use instructional technology efficiently.	131	1	2	1.93	.254
I feel confident that I can learn to use instructional technology tools independently.	131	1	2	1.86	.346
I feel confident that when I use instructional technology, I can solve technical problems if I face them.	130	1	2	1.60	.492
I feel confident that I am able to download programs on the Internet.	131	1	2	1.88	.329
Self-Efficacy Towards Technology Integration					
I feel confident that I can integrate instructional technology as a meaningful part of my teaching.	131	1	2	1.95	.226
I feel confident that I can find new ways to apply instructional technology in my teaching.	131	1	2	1.92	.278
I feel confident that I can create meaningful learning experiences for my students with instructional technology.	131	1	2	1.95	.226
I feel confident that I can apply instructional technology to enhance my students' learning.	131	1	2	1.95	.226

[a]Data could not be interpreted.

Table 5

Self-Efficacy Level Frequencies

		Frequency	
		Enhancement	Transformation
Teaching Self-Efficacy			
I feel confident that I can create meaningful learning experiences for my students.	Disagree	4	0
	Agree	79	48
I feel confident that I can motivate my students to be actively involved in their learning.	Disagree	1	0
	Agree	82	48
I feel confident that I can develop my teaching.[a]	Disagree	0	0
	Agree	83	48
Computer Self-Efficacy			
I feel confident that I can use instructional technology efficiently.	Disagree	9	0
	Agree	74	48
I feel confident that I can learn to use instructional technology tools independently.	Disagree	11	7
	Agree	72	41
I feel confident that when I use instructional technology, I can solve technical problems if I face them.	Disagree	34	18
	Agree	49	29
I feel confident that I am able to download programs on the Internet.	Disagree	6	10
	Agree	77	38
Self-Efficacy Towards Technology Integration			
I feel confident that I can integrate instructional technology as a meaningful part of my teaching.	Disagree	7	0
	Agree	76	48
I feel confident that I can find new ways to apply instructional technology in my teaching.	Disagree	9	2
	Agree	74	46
I feel confident that I can create meaningful learning experiences for my students with instructional technology.	Disagree	7	0
	Agree	76	48
I feel confident that I can apply instructional technology to enhance my students' learning.	Disagree	7	0
	Agree	76	48

Note. Enhancement represents the Substitution and Augmentation categories; Transformation represents the Modification and Redefinition categories.

[a]Data could not be interpreted.

Results of the independent samples t-tests (see Table 6) determined significance of self-efficacy towards technology integration. The *t*-test found of t = -2.600, df = 129 produced a significantly statistical difference between groups at p = .047 where p is significant at the .05 level. Self-efficacy towards technology integration and SAMR outcomes were statistically significant though the other two types - computer self-efficacy and teaching self-efficacy - were not significant.

Table 6

Independent Samples t-tests for SE and SAMR Outcomes

	df	t	p
Teaching Self-Efficacy			
I feel confident that I can create meaningful learning experiences for my students.	82.000	-2.038	**0.045***
I feel confident that I can motivate my students to be actively involved in their learning.	129.000	-0.759	0.449
I feel confident that I can develop my teaching.[a]			
Computer Self-Efficacy			
I feel confident that I can use instructional technology efficiently.	82.000	-3.158	**0.002***
I feel confident that I can learn to use instructional technology tools independently.	129.000	0.212	0.833
I feel confident that when I use instructional technology, I can solve technical problems if I face them.	128.000	-0.296	0.768
I feel confident that I am able to download programs on the Internet.	69.303	2.068	**0.042***
Self-Efficacy Towards Technology Integration			
I feel confident that I can integrate instructional technology as a meaningful part of my teaching.	82.000	-2.748	**0.007***
I feel confident that I can find new ways to apply instructional technology in my teaching.	127.368	-1.482	0.141
I feel confident that I can create meaningful learning experiences for my students with instructional technology.	82.000	-2.748	**0.007***
I feel confident that I can apply instructional technology to enhance my students' learning.	82.000	-2.748	**0.007***
Sum of...			
Teaching Self-Efficacy	82.000	-1.920	0.058
Computer Self-Efficacy	129.000	0.264	0.792
Self-Efficacy Towards Technology Integration	91.486	-2.600	**0.011***
All Self-Efficacy Categories	128.237	-1.260	0.210

Note. SE = Self-Efficacy; SAMR = Substitution, Augmentation, Modification, Redefinition.

[a]Data could not be interpreted.

*$p < .05$

Specifically, there were questions in each of the self-efficacy categories that registered as significant. “I feel confident that I can create meaningful experiences for my students” showed significance in Teaching Self-Efficacy at $p = .045$ but the category overall was not significant. Responses for “I feel confident that I can use instructional technology efficiently” indicated significance at $p = .002$ in the Computer Self-Efficacy category but not the whole category.

Multiple questions in the Self-Efficacy Towards Technology Integration showed significance. There were four questions that were asked in this category and three out of the four questions were found to be statistically significant. All three questions, “I feel confident that I can integrate instructional technology as a meaningful part of my teaching”, “I feel confident that I can create meaningful learning experiences for my students with instructional technology”, and “I feel confident that I can apply instructional technology to enhance my students’ learning” were significant at $p = .007$.

One question from the questionnaire, “I feel confident that I can develop my teaching”, resulted in all participants selecting Agree. Since no one selected Disagree, calculations could not be completed and, without data, could not be interpreted.

RQ2: Do in-service teachers’ perceived usefulness of instructional technology affect the SAMR outcome scores of integrating technology into their lesson plans?

Perceived Usefulness (PU) responses were taken from 15 of the 32 questions in the online questionnaire. Table 7 displays descriptive data for participants’ responses for those 15 questions. Frequency of lesson plans that were observed at the enhancement or transformation levels (see Table 8) are indicated for each question related to PU.

Table 7

TAM 2 Perceived Usefulness Descriptives

	N	Min	Max	M	SD
Perceived Usefulness					
Integrating technology into my lesson plans improves my performance in my job.	131	1	2	1.92	.267
Integrating technology into my lesson plans enhances my effectiveness in my job.	131	1	2	1.96	.192
Subjective Norm					
People who influence my behavior think that I should integrate technology into my lesson plans.	131	1	2	1.78	.417
Voluntariness					
Integrating technology into my lesson plans is voluntary.	131	1	2	1.69	.462
My principal does not require me to integrate technology into my lesson plans.	131	1	2	1.53	.501
Image					
People in my organization who integrate technology into their lesson plans have a high profile.	131	1	2	1.74	.440
People in my organization who integrate technology into their lesson plans have more prestige than those who do not.	131	1	2	1.63	.486
Job Relevance					
In my job, technology integration in my lesson plans is important.	131	1	2	1.89	.310
In my job, technology integration in my lesson plans is relevant.	131	1	2	1.93	.254
Output Quality					
The quality of the output I get from integrating technology into my lesson plans is high.	131	1	2	1.80	.402
Results Demonstrability					
The results of integrating technology into my lesson plans are apparent to me.	131	1	2	1.89	.320
I have no difficulty telling others about the results of integrating technology into my lesson plans.	131	1	2	1.89	.320
Perceived Ease of Use					
Integrating technology into my lesson plans is a clear and understandable task.	131	1	2	1.92	.278
Integrating technology into my lesson plans does not require a lot of mental effort.	131	1	2	1.49	.502
I find integrating technology into my lesson plans an easy task.	131	1	2	1.73	.444

Note. TAM 2 = Technology Acceptance Model 2.

Table 8

TAM 2 Perceived Usefulness Frequencies

		Frequency	
		Enhancement	Transformation
Perceived Usefulness			
Integrating technology into my lesson plans improves my performance in my job.	Disagree	5	5
	Agree	78	43
Integrating technology into my lesson plans enhances my effectiveness in my job.	Disagree	3	2
	Agree	80	46
Subjective Norm			
People who influence my behavior think that I should integrate technology into my lesson plans.	Disagree	17	12
	Agree	66	36
Voluntariness			
Integrating technology into my lesson plans is voluntary.	Disagree	29	11
	Agree	54	37
My principal does not require me to integrate technology into my lesson plans.	Disagree	43	18
	Agree	40	30
Image			
People in my organization who integrate technology into their lesson plans have a high profile.	Disagree	22	12
	Agree	61	36
People in my organization who integrate technology into their lesson plans have more prestige than those who do not.	Disagree	30	19
	Agree	53	29
Job Relevance			
In my job, technology integration in my lesson plans is important.	Disagree	10	4
	Agree	73	44
In my job, technology integration in my lesson plans is relevant.	Disagree	6	3
	Agree	77	45
Output Quality			
The quality of the output I get from integrating technology into my lesson plans is high.	Disagree	18	8
	Agree	65	39
Results Demonstrability			
The results of integrating technology into my lesson plans are apparent to me.	Disagree	13	2
	Agree	70	46
I have no difficulty telling others about the results of integrating technology into my lesson plans.	Disagree	11	4
	Agree	72	44
Perceived Ease of Use			
Integrating technology into my lesson plans is a clear and understandable task.	Disagree	9	2
	Agree	74	46
Integrating technology into my lesson plans does not require a lot of mental effort.	Disagree	49	18
	Agree	34	30
I find integrating technology into my lesson plans an easy task.	Disagree	29	6
	Agree	54	42

Note. TAM 2 = Technology Acceptance Model 2; Enhancement represents the Substitution and Augmentation categories; Transformation represents the Modification and Redefinition categories.

Results of the independent samples t-tests (see Table 9) did not find significance between groups for the overall PU scores and SAMR level outcomes. However, significance between PU and SAMR outcomes were found for the specific variables of Results Demonstrability (RD) and Perceived Ease of Use (PEU). The *t*-test for the RD question "The results of integrating technology into my lesson plans are apparent to me" found a $t = -2.318$, $df = 128.798$ indicating a statistical difference between RD and

SAMR outcomes at p = .022. The *t*-tests for two PEU questions “Integrating technology into my lesson plans does not require a lot of mental effort” and “I find integrating technology into my lesson plans an easy task” found a t = -2.410, df = 129 produced a statistically significant difference between PEU and SAMR level outcomes at p = .017 and t = -3.142, df = 124.450 produced a statistical significant difference between PEU and SAMR level outcomes at p = .002, respectively. The level of significance for all questions was $p < .05$.

Table 9

Independent Samples t-tests for TAM 2 Percieved Usefulness (PU) and SAMR Outcomes

	df	t	p
Perceived Usefulness			
Integrating technology into my lesson plans improves my performance in my job.	129.000	0.908	0.365
Integrating technology into my lesson plans enhances my effectiveness in my job.	129.000	0.158	0.875
Subjective Norm			
People who influence my behavior think that I should integrate technology into my lesson plans.	129.000	0.596	0.552
Voluntariness			
Integrating technology into my lesson plans is voluntary.	108.172	-1.488	0.140
My principal does not require me to integrate technology into my lesson plans.	100.452	-1.596	0.114
Image			
People in my organization who integrate technology into their lesson plans have a high profile.	129.000	-0.188	0.851
People in my organization who integrate technology into their lesson plans have more prestige than those who do not.	129.000	0.389	0.698
Job Relevance			
In my job, technology integration in my lesson plans is important.	129.000	-0.659	0.511
In my job, technology integration in my lesson plans is relevant.	129.000	-0.212	0.833
Output Quality			
The quality of the output I get from integrating technology into my lesson plans is high.	128.000	-0.635	0.527
Results Demonstrability			
The results of integrating technology into my lesson plans are apparent to me.	128.798	-2.318	**0.022***
I have no difficulty telling others about the results of integrating technology into my lesson plans.	129.000	-0.848	0.398
Perceived Ease of Use			
Integrating technology into my lesson plans is a clear and understandable task.	127.368	-1.482	0.141
Integrating technology into my lesson plans does not require a lot of mental effort.	129.000	-2.410	**0.017***
I find integrating technology into my lesson plans an easy task.	124.450	-3.142	**0.002***
Sum of...			
Perceived Usefulness	129.000	-1.524	0.130

Note. p-values are in boldface. TAM 2 = Technology Acceptance Model 2; SAMR = Substitution, Augmentation, Modification, Redefinition.

*p < .05

RQ3: Do differences in SAMR score outcomes connect to differences in in-service teachers' perceived ease of use scores?

Perceived Ease of Use (PEU) responses were taken from 3 of the 32 questions in the online questionnaire. Descriptive statistics and frequency of lesson plans observed at the enhancement and transformation levels are displayed in Table 10 and Table 11, respectively.

Table 10

TAM 2 Perceived Ease of Use Descriptives

	N	Min	Max	M	SD
Perceived Ease of Use					
Integrating technology into my lesson plans is a clear and understandable task.	131	1	2	1.92	.278
Integrating technology into my lesson plans does not require a lot of mental effort.	131	1	2	1.49	.502
I find integrating technology into my lesson plans an easy task.	131	1	2	1.73	.444

Note. TAM 2 = Technology Acceptance Model 2.

Table 11

TAM 2 Perceived Ease of Use Frequencies

		Frequency	
		Enhancement	Transformation
Perceived Ease of Use			
Integrating technology into my lesson plans is a clear and understandable task.	Disagree	9	2
	Agree	74	46
Integrating technology into my lesson plans does not require a lot of mental effort.	Disagree	49	18
	Agree	34	30
I find integrating technology into my lesson plans an easy task.	Disagree	29	6
	Agree	54	42

Note. TAM 2 = Technology Acceptance Model 2.

Results of the independent samples t-tests (see Table 12) did find significance between groups for the overall PEU scores. The *t*-test for PEU found a $t = -3.263$, $df = 122.324$ produced a statistical significant difference between PEU and SAMR level outcomes at $p = .001$.

Table 12

Independent Samples t-tests for TAM 2 Perceived Ease of Use (PEU) and SAMR Outcomes

	df	t	p
Perceived Ease of Use			
Integrating technology into my lesson plans is a clear and understandable task.	127.368	-1.482	0.141
Integrating technology into my lesson plans does not require a lot of mental effort.	129.000	-2.410	**0.017***
I find integrating technology into my lesson plans an easy task.	124.450	-3.142	**0.002***
Sum of...			
Perceived Ease of Use	122.324	-3.263	**0.001***

Note. p-values are in boldface. TAM 2 = Technology Acceptance Model 2; SAMR = Substitution, Augmentation, Modification, Redefinition.

*p < .05

The *t*-tests for two PEU questions “Integrating technology into my lesson plans does not require a lot of mental effort” and “I find integrating technology into my lesson plans an easy task” found a $t = -2.410$, $df = 129$ produced a statistical significant difference between PEU and SAMR level outcomes at $p = .017$ and $t = -3.142$, $df = 124.450$ produced a statistical significant difference between PEU and SAMR level outcomes at $p = .002$, respectively. The level of significance for all questions was $p < .05$.

Chapter 5: Discussion and Conclusions

Discussion of the Findings

The purpose of this study was to investigate in-service teachers' self-reported self-efficacy, perceived ease of use, and perceived usefulness scores relationship to SAMR (Substitution, Augmentation, Modification, Redefinition) level outcomes of submitted lesson plans. The study used Puentedura's (2006) definitions of each level for the evaluation of the level of technology integration in participants' lesson plans. The Substitution level is technology used as a direct tool substitute with no functional change and the Augmentation levels technology used as a direct tool substitute with functional improvement. These levels together make up the Enhancement stage of SAMR. The Modification level is when technology is used to create an entirely new task design and the Redefinition level is when technology is used for the creation of new tasks previously inconceivable without technology. Both the Modification and Redefinition levels are considered the Transformation stage of learning experiences in SAMR.

Changes were made by the researcher to accommodate the analyses of the SAMR categories for each instrument item where all levels were not represented. Analysis would be difficult without each of the four SAMR levels represented to compare across self-efficacy, perceived ease of use, and perceived usefulness groups. In order to make this accommodation, the dependent variable - SAMR - was collapsed from the four separate levels mentioned above to the two categories - enhancement and transformation based on Puentedura's (2006) framework. In conjunction with this decision, variables such as self-efficacy, perceived ease of use, and perceived usefulness, measured on a 4-point Likert scale (1 = *strongly disagree* and 4 = *strongly agree*) were collapsed to two categories (1 = *disagree* and 2 = *agree*). By collapsing the independent variables to two categories to match the dependent variable – SAMR, the researcher was then able to utilize *t*-tests for data analysis to show differences between the groups.

Data analysis was based on the 131 participant responses collected. Initially, 221 survey responses were submitted, but 90 of those completed surveys did not include a submitted lesson plan. Without a submitted lesson plan, comparable outcomes could not be made between the self-reported scores for self-efficacy, perceived ease of use, and perceived usefulness and SAMR levels. Possible reasons for participants to complete the survey but not submit a lesson plan could be a lack of time or lack of preparedness to submit while completing the survey instrument. Another reason a participant might not have submitted a lesson plan is due to their lack of confidence in using technology and did not want to admit he/she did not feel comfortable in using technology. The following discussion will interpret the 131 participant responses that did accompany a lesson plan with their survey.

Self-Efficacy Scale

Participants reported their confidence levels in the categories of teaching self-efficacy, computer self-efficacy, and self-efficacy towards technology integration. The scores from participants' responses were then compared to the SAMR level of instructional technology integration their lesson plan exhibited. The self-efficacy questions were designed to answer the first research question which was the following "Do differences in in-service teachers' self-reported self-efficacy levels connect to the different SAMR scores obtained from teachers' lesson plans that have instructional technology embedded in them?"

Analysis of the self-efficacy questions showed that in-service teachers were overall confident in their teaching ability. One exception was teachers' confidence in creating meaningful learning experiences as compared to the SAMR level outcomes of their lesson plans. This signifies that teachers felt confident in their teaching but their technology integration in their lesson plans fell on the lower levels of the SAMR model - Substitution (S) and Augmentation (A) levels - which aligns with outcomes found in previous studies (Ertmer & Ottenbreitt-Leftwich, 2010; Spaulding, 2013). Many teachers feel that they produce quality lessons and are average to superior when it comes to their ability to teach students. However, with the indication that teachers lack confidence in creating meaningful experiences, targeted professional development (PD) is necessary. Teachers could benefit from the modeling of how effective technology integration at the M and R levels can create meaningful learning experiences for students.

Overall analysis of participants' computer self-efficacy determined that they felt confident and ready to learn instructional technology tools. Further investigation found that though they were confident and ready to learn, their SAMR level outcomes of technology integration in lesson plans did not match their confidence for "I feel confident that I can use instructional technology efficiently." Participants believed they were capable of using technology efficiently but were doing so at low SAMR levels. This particular question could be broken down into more detail to find out which technology tools teachers felt efficient with and which tools they did not. Qualitative information was not gathered from participants in this study. Investigating which type of technology tools in-service teachers were ready and able to use and which they are not could pinpoint where gaps are in the current PD structure. A more structured PD course of action could be instituted and tailored to each teacher's needs.

The self-efficacy towards technology integration category was where participants mostly felt confident with integrating instructional technology into their lessons as based on frequency of responses. However, when those responses were compared with actual level of technology integration, analyses for each question showed that most in-service teachers were integrating at the S and A levels. This further aligns with previous research that determined in-service teachers need to be shown how to integrate technology into their lesson plans to produce better integration outcomes (Geer et al., 2017; Reid, 2014).

Findings from the first research question suggests a need for in-service teachers to be provided PD that would increase their use of technology, how to use technology, and how to integrate technology efficiently and effectively in their lessons. It seems that teachers feel confident in using technology, but most do so at low levels. A teacher who has students type their research paper in a Google Doc may feel confident in his/her ability to use Google Docs, but this level of integration is merely a substitute for having the student write with pencil and paper. There is no pedagogical shift in instruction when technology is integrated at the Substitution level. This particular teacher would need targeted PD to show him/her how to integrate the use of Google Docs effectively at the higher levels of SAMR. For example, this teacher could have students create their paper in Google Docs (S), share it with classmates and the teacher (A), receive peer and teacher feedback via the commenting feature (M), and connect their class of students with a class from another geographic location via a web conferencing tool to have students present their papers and participate in class discussions about their topics (R).

Teaching today requires that in-service teachers have a solid understanding of how to use technology and integrate technology effectively and efficiently into daily lessons. This is even more prevalent now with the impact that the COVID pandemic and subsequent school shutdowns is having on the foundation of the educational system itself. Technology is no longer an add-on; it is the means of which teaching and learning is happening. If this is the expectation, then teachers should be provided adequate time to not only learn how to use a tool, but to utilize it effectively for meaningful learning to take place. The fact that teachers mostly felt confident about integrating technology is a good sign we are moving in the right direction. Now, in-service teachers need to participate in active and engaging PD that provides them the time and the skillset to confidently and effectively design lessons that integrate technology at all levels of SAMR.

A structured PD (PD) plan tailored to teachers' needs would look at learning outcome expectations, the design of learning tasks needed, current technology tools and resources accessible by teachers, technology tools and resources needed by teachers, and conduct a gap analysis of where teachers currently are and where they need to be in relation to instructional technology integration practices. Looking at the first piece to a structured PD plan, learning outcome expectations, school districts would need to understand what their students need and what they expect as a result of successful teaching and learning. Once districts detail their expectations, they can then work backwards to design a PD plan that will seek to meet those expected outcomes.

Next, school districts will want to review and develop curricula and standards that align with the expected learning outcomes. Once they have a strong curriculum to focus their pedagogy around, districts can then begin to design learning tasks to afford their learners the opportunity for authentic experiences. The majority of in-service teachers' PD will involve teaching and modeling how to design these learning tasks in conjunction with effective practices in integrating technology. This is where a gap analysis is needed to find out where teachers are in their technology abilities and use of resources they already have access to; what technology resources they may need to meet learning expectation outcomes and the skillset to be successful in using these resources; and what resources and training are necessary to fulfill the need for authentic learning experiences.

The idea that in-service teacher PD revolving around teaching strategies and content is separate from PD given on instructional technology integration and lesson design with technology is where the disconnect is happening. A structured and intentional approach to providing PD to in-service teachers that combine all aspects of teaching and learning together is necessary for progress and the growth of teachers' self-efficacy, perceived ease of use, and perceived usefulness towards the effective integration of technology utilized for teaching and learning. Many in-service teachers are at different ability levels when it comes to integrating technology or even their comfortability with basic technology skills. District PD; therefore, should be personalized and targeted to meet teachers where they are and continue to develop their basic skills and transform them into teachers who are confident in effectively utilizing technology for teaching and learning. Succeeding at this would mean a path to the district's learning expectation outcomes being met.

TAM 2 Scale

The TAM 2 scale comprises two determinants, Perceived Usefulness (PU), defined as the belief that a certain technology will help a person efficiently and effectively perform a job-related task (Davis et al., 1989), and Perceived Ease of Use (PEU), defined as a user's perception of how much effort it takes to use the technology (Venkatesh & Davis, 2000). This study used the TAM 2 rather than TAM to determine whether social processes or cognitive instrumental processes affected the use of integration of instructional technology in lesson plans. The belief was that there were more factors than just PU and PEU that influenced a person's perceived ability to use technology.

The purpose of measuring PU scores was to answer research question two, "Do in-service teachers' perceived usefulness of instructional technology affect the SAMR outcome scores of integrating technology into their lesson plans?" In this study, participants believed they were efficiently and effectively integrating instructional technology into lesson plans, and overall, analysis of PU determined that SAMR level outcomes in lesson plans were not impacted based on self-reported PU scores. This could indicate that these in-service teachers do find that integrating technology is a useful part of their job and integrate at different levels based on the SAMR model. This finding is a positive step in the right direction. The district will need to capitalize on this and build PD for in-service teachers to extend the use of technology to not just be useful but to be impactful for teaching and learning.

One cognitive instrumental process variable, titled, *results demonstrability*, did show significance through data analysis. The questionnaire item “The results of integrating technology into my lesson plans are apparent to me,” indicated a relationship between self-reported PU scores and the level of integration in their lesson plans as shown in Table 9. However, it was not enough to demonstrate that social processes and/or cognitive instrumental processes were indicative of the SAMR level of technology integration in-service teachers included in their lesson plans. This indicated that teachers felt technology is useful in their jobs, they use it, but do not see the effectiveness or impact on students’ learning outcomes.

If teachers are unsure about the results of integrating technology, they may not be appropriately planning their lessons to produce impactful learning outcomes. In-service teachers should be provided PD that not only helps them utilize technology but also how to select appropriate tools to integrate technology in their lessons for effective learning outcomes. A strategic approach demonstrating to in-service teachers’ effective ways to design lessons incorporating the selection of appropriate technology that impacts learning outcomes should be a goal of a targeted PD plan. School districts must provide PD to in-service teachers that empowers them to create and design authentic learning tasks for students, leveraging innovative technology integration and pedagogy that result in successful learning outcomes which are readily observed by teachers.

Further inquiry discovered that PEU, a direct determinant of PU and falls under the cognitive instrumental processes' domain, was significant in affecting PU (Venkatesh & Davis, 2000). Social processes and cognitive instrumental processes, thought to impact PU, did not show as impactful in this study. Results in this study may have been the same even if the original TAM was utilized in the study instead of TAM 2 because PEU was a direct determinant in the original TAM as well. This leads us to the discussion of the third research question.

PEU was measured in this study to answer the third research question, "Do differences in SAMR score outcomes connect to differences in in-service teachers' perceived ease of use scores?" Teachers believed that "integrating technology into their lesson plans was an easy task" and "integrating technology into lesson plans did not require a lot of mental effort" but actual integration of instructional technology in those lesson plans were at the S and A levels. This suggests that while they feel integrating technology was easy, in-service teachers integrated at the lowest levels according to SAMR.

A possible conclusion could be that because in-service teachers are integrating technology at the lowest levels, the technology they are utilizing is easy for them to learn. The problem with this is that teachers are not creating authentic and meaningful experiences for students that reach beyond the four walls of the classroom if they are not integrating at the M and R levels.

With the expectation that teachers must integrate technology and evidence of student learning outcomes is the goal, then the focus of school districts should be on producing well-trained teachers who can effectively design lessons that integrate instructional technology for the benefit of student learning outcomes. To succeed in this, the district must implement a PD plan that gives teachers time and resources to plan lessons accordingly. Not only do school districts need to provide time and resources for in-service teachers, but they must also provide effective and practical examples of technology integration in conjunction with lesson design and how it impacts student learning. Making assumptions that teachers know how to design these meaningful experiences with technology without providing essential PD harms the progress of teachers in the classroom and affects our most important benefactors - students.

It is time for school districts to do away with sit-and-get PD where teachers attend a session and sit as presenters talk at them for any length of time. This style of PD does not differentiate the information to teachers based on skill level or need, engage teachers in active learning, nor provide time to dive into the learned material to elicit understanding. Just like teachers are responsible for developing innovative teaching practices to secure learning outcomes for students, school districts should be responsible for developing and implementing innovative PD structures that ensure learning outcomes for teachers.

Delimitations

The first delimitation for this study was the relatively small sample size for this study. The sample was taken from a single school district with only 131 participants. As shown in Table 1, this sample; however, ended up with an almost even spread of participants across the grade bands of K-5, 6-8, and 9-12. The researcher chose this district out of convenience and may have benefitted to include other districts in the region to produce a larger sample size. Future studies may want to include a larger sample and a more diverse sample from school districts in other geographical areas.

A second delimitation of this study was the possibility of an effect on the sample from the COVID-19 pandemic. The instrument was given amid the pandemic while the school district moved to virtual learning and teachers were teaching remotely. Given the situation, an assumption can be made that all teachers were utilizing technology for teaching and learning to some extent. If participants responded prior to the pandemic when they were teaching face-to-face, responses may have been different or illustrated a better snapshot of where the in-service teachers were with integrating technology into lesson plans.

Limitations

A limitation of this study was that the measures of self-efficacy and TAM 2 were all self-reported. It might be useful to find out why certain teachers were confident in some areas but not others or why they perceived certain aspects of technology integration useful or not. If this study were to be conducted again, it might be useful to know the types of technology integrated and how they are being utilized in lessons. The instrument in this study was not designed to gather information on which instructional technology tools teachers used, which tools they felt uncomfortable/comfortable using, or how they were integrating each tool. Understanding the “why,” “what,” and “how,” would help to design targeted PD for in-service teachers.

Implications and Recommendations

If this study only relied on the results of the questionnaire to determine instructional technology integration, one would assume that in-service teachers are integrating well and at higher levels. We could easily assume that confidence levels equate to good technology integration. As was determined from PEU and Self-Efficacy analyses, in-service teachers are integrating technology into lesson plans and they are confident in their abilities; however, SAMR level outcomes show they are only integrating at the enhancement level (Substitution and Augmentation). This is important to note for school districts so they can provide appropriate PD to their teachers. Districts do not want to start at the beginning and introduce technology if teachers are already using it. But they will want to know which tools they are using and provide PD demonstrating how to transform teaching at the Modification and Redefinition levels. The current study extended the knowledge on the level of integrated technology within in-service teachers' lesson plans compared with self-reported self-efficacy and TAM 2 scores. Moving forward, school districts will want to account for teachers' confidence with integrating technology, their perceived ability to do so, and whether teachers feel that certain technology is useful in their jobs. Delineating this information would be imperative to structuring and developing a comprehensive PD plan that emphasizes effective practices of integrating technology in lesson plans resulting in expected learning outcomes.

Teachers who are integrating at low levels of SAMR - S and A, may feel that the technology they are utilizing is easy to use and exhibit high levels of self-efficacy in using these tools. But, if all the technology they are integrating falls into the enhancement category, they are not shifting their instructional methodologies to design lessons that encourage students to interact with and think about a larger community than inside their own classroom. Teachers are designing engaging lessons integrating technology; however, the end results produced by students do not go further than the classroom. These end results students produce include, but are not limited to, creating videos with iMovie; presenting research in Google Slides; typing a paper in Google Docs; architecting an infographic, poster, or chart; among many other options. While using any of these choices for students to demonstrate learning are engaging activities, these options do not go far enough to transform learning at the M and R levels in SAMR.

Having students research a topic and present their findings in a Google Slides, for example, should be just the beginning. Take this a step further to get peer feedback or narrate over the slides to create a video production of your information. To reach M and R levels, post your video on a blog for viewing by an authentic audience. In order to reach Redefinition, allow interaction between students and the authentic audience. The ability to interact with individuals outside your school, community and/or region exemplifies Redefinition - creating tasks that were previously inconceivable without technology (Puentedura, 2006).

The literature reviewed for this study established the need for intentional PD based on lesson design that included integrating instructional technology (Davidson et al., 2015; Reid, 2014). Notably, the literature established a need for positively building teacher self-efficacy in regard to integrative practices of lesson design and technology (Adegbenro et al., 2017; Moore-Hayes, 2011; Pan & Franklin, 2011; Williams, 2017). In-service teachers may feel better equipped to integrate instructional technology and integrate at the highest levels in their lesson plans if they had reliable models to exemplify what high levels of integration looks like.

By understanding confidence levels of in-service teachers, their perceived abilities to use instructional technology and integrate it into lesson plans, and determining their level of integration, school districts and school leaders can begin to construct meaningful PD that focuses on effectively integrating technology into lesson plans. Not only could this PD be designed around effective integration, but on how to design instructional experiences for students at the transformational levels (Modification and Redefinition) in accordance with the SAMR model. This understanding by K-12 school districts would align with previous research that signified that a structured PD plan designed around effective integration in lesson planning would assist in-service teachers in moving from the enhancement level to transformational (Geer et al., 2017; Kilpatrick et al., & Graham, 2014).

We also must keep in mind that this study was completed amidst the COVID19 global pandemic. Many teachers were forced into using technology they did not feel confident in utilizing like web-conferencing tools and electronic assignment submission formats. The results of this study can help prepare for PD for in-service teachers in a post-COVID educational structure. Teachers will need to learn and understand how to move their traditional pedagogies and strategies to an online teaching and learning environment. Future PD should not only encompass current effective instructional technology integration practices but also focus on what that looks, feels, and acts like in a solely online environment as well.

School districts should not have to solely shoulder the load of training teachers to be effective users of technology. This study focused on the perceptions and beliefs of in-service teachers, but the findings and conclusions could be applicable to teacher preparation programs as well. Eventually, their teacher candidates will become in-service teachers. If first year teachers were confident in integrating technology and perceived the use of integrating technology as an easy task, then they can also be prepared to integrate at higher levels on the SAMR model before stepping into an in-service teacher role. Teacher preparation programs can begin to construct programs that integrate instructional technology lesson planning into curriculum-based courses.

Future research should involve developing a course or PD plan for in-service teachers focused on lesson design with effective higher-level integration of technology. By implementing a specific PD plan focused on lesson plan design with technology, outcomes of technology integration in lessons could be measured on the SAMR scale. With the rapid evolvement of technology tools, research would be better utilized if based on instructional design and integrative measures using such frameworks as Technological Pedagogical and Content Knowledge (TPACK) and SAMR rather than specific technology tools.

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APPENDIX A

Scripted Email

Dear Prospective Participant,

My name is Jordan Cotten and I am a doctoral candidate from Duquesne University. I am writing to invite you to participate in my research study about in-service teachers' instructional technology integration in their lesson plans. Participation in this study is voluntary and all survey responses will remain anonymous.

If you decide to participate in this study, the survey will take approximately 15 minutes to complete and will need to be completed at one time. You will be asked to upload a sample lesson plan and answer 32 questions. Your identity and data will be kept anonymous from myself or anyone else. All responses and data will be kept confidential and will not be shared with your school district nor will you be compensated for your participation.

Remember, participation in this study is voluntary and you may opt out at any time. If you choose to move forward with participation, please click on the link below to access the survey. If you have any questions or concerns, please email me at any time.

Survey Link

Thank you for your consideration.

Sincerely,

Jordan Cotten
Duquesne University Doctoral Candidate

APPENDIX B

INFORMED CONSENT TO PARTICIPATE IN A RESEARCH STUDY

TITLE:
In-Service Teachers' Ability to Integrate Instructional Technology into Lessons Based on SAMR Level Outcomes and their Perceived Ease of Use, Perceived Usefulness, and Self-efficacy

INVESTIGATOR:
Jordan L. Cotten | Duquesne University | cottenj@duq.edu

ADVISOR:
Dr. David Carbonara | Duquesne University | School of Education, Department of Instruction and Leadership | 412-396-4039 | carbonara@duq.edu

SOURCE OF SUPPORT:
This study is being performed as partial fulfillment of the requirements for the doctoral degree in Instructional Design and Leadership at Duquesne University.

STUDY OVERVIEW:
This study seeks to identify in-service teachers' perceived ease of use, perceived usefulness and self-efficacy pertaining to the integration of instructional technology and the outcome levels in teacher lesson plans as measured by the SAMR model. A 32-question online survey will be used to collect participant data. Your participation is voluntary and, if you choose to participate, you can opt out at any time. All in-service teaching staff will be given the opportunity to participate.

PURPOSE:
You are being invited to participate in a research study that seeks to investigate in-service teachers' ability to integrate instructional technology into lesson plans based on SAMR level outcomes and their perceived ease of use, perceived usefulness, and self-efficacy. This study will utilize a questionnaire containing demographic questions, Technology Acceptance Model 2 (TAM 2) questions, and self-efficacy questions to determine differences in in-service teachers' perceived ease of use, perceived usefulness, and self-efficacy levels and SAMR level outcomes in lesson plans.

PARTICIPANT PROCEDURES:
The questionnaire is offered to all in-service teachers from the chosen district currently instructing in the curriculum area of their certification for students in grades kindergarten through twelve.

Participation in the research study will consist of completion of a 32 item questionnaire which is contained online with the researcher's university Qualtrics account. At the end of the questionnaire, participants will be asked to upload a sample lesson plan. Completion of the questionnaire is not expected to exceed fifteen minutes. Participants may choose any location, date, and time in which to complete the questionnaire as long as it is within the data collection period of two weeks; however, it must be completed in one sitting.

RISKS AND BENEFITS:

There are minimal risks to participation in this study. Confidentiality will be protected due to no identifying information being collected. If at any time a question or participation makes you uncomfortable, you may stop at any time and your data will not be used. There is a low risk to the participants that this confidentiality might be breached.

COMPENSATION:

At no time will compensation be given in exchange for your participation in this study. Your participation is voluntary.

CONFIDENTIALITY:

Your privacy and confidentiality are important to this researcher. The researcher is making every effort to protect all participants' personal information. Data collection with this survey will not ask for any identifying characteristics like name, email address, or any other identifiable information. Once you have completed the questionnaire, the data is collected using a password protected Qualtrics survey. No email address, IP address or any other electronic information is requested or recorded. The data will be kept confidential and the computer will be password protected. Responses to the questionnaire will be kept secure as per the Qualtrics security statement found here: https://www.qualtrics.com/security-statement/. The Qualtrics survey and data platform uses Transport Layer Security encryption (TLS), also known as HTTPS. The raw data will be kept for three years following the close of the study. At the conclusion of the three years, the data will be destroyed/deleted. In addition, any publications or presentations about this research will only use data that is combined together with all subjects; therefore, no one, including the researcher, will be able to determine how you responded.

RIGHT TO WITHDRAW:

Your participation in this study is strictly voluntary. There are no penalties or consequences of any kind if you decide that you do not want to participate. You are free to refuse to participate or continue on with the questionnaire at any time. If you do choose not to participate, simply close out of the survey at any time. By doing this, your data will not be collected or included in the study.

SUMMARY OF RESULTS:

A summary of the results of this study will be provided at no cost. You may request this summary by contacting the researcher and requesting it. The information provided to you will not be your individual responses, but rather a summary of what was discovered during the research project as a whole.

VOLUNTARY CONSENT:
When signing this form, I am agreeing to voluntarily enter this study. I have had the opportunity to read the informed consent and it was explained to me in a language which I use. I understand that I am free to withdraw for any reason from participation at the end of the questionnaire before submitting my answers which will delete all of my data. Please choose your participation in this study from the choices below or simply close out of the questionnaire.

I understand that if I have further questions about my participation in this research study, I may contact Jordan Cotten at cottenj@duq.edu. If I have any questions regarding my rights and protections as a subject in this study, I can contact Dr. David Delmonico, Chair of the Duquesne University Institutional Review Board for the Protection of Human Subjects at 412.396.1886 or at irb@duq.edu.

- I agree to participate in this study.
- I do not agree to participate in this study.

APPENDIX C

RESEARCH QUESTIONNAIRE

DEMOGRAPHIC QUESTIONS	
How many years have you been teaching? (Respond numerically and round up to the next whole number - e.g. teaching for 7 months = 1 year)	
In which content area do you teach? (Please select your current teaching assignment. If you teach in more than one content area, please select your main content area.)	World Language ____ Social Studies/History ____ English/ELA ____ Math ____ Science____ Fine Arts _____ Technology & Engineering___ Business, Computer, & IT____ Food & Consumer Sciences____ Health & Physical Education___ Library___ AFJROTC____ Special Education___ Gifted___ Other (please list)___________
What grade levels do you currently teach? (Check all that apply)	K_ 1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9_ 10_ 11_ 12_
Within a unit of study, how often do you integrate instructional technology into your lesson plans?	Daily ____ Weekly ____ Monthly ____ Per Unit ___
From which university/college did you obtain your teaching certification?	
TECHNOLOGY ACCEPTANCE MODEL 2 QUESTIONS ***Read each statement below. Indicate how much you (1) strongly disagree to (4) strongly agree with each statement.*** ***1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree***	
Given that I have access to technology, I intend to integrate technology into my lesson plans.	1 2 3 4
Integrating technology into my lesson plans improves my performance in my job.	1 2 3 4

Integrating technology into my lesson plans enhances my effectiveness in my job.	1	2	3	4
Integrating technology into my lesson plans is a clear and understandable task.	1	2	3	4
Integrating technology into my lesson plans does not require a lot of mental effort.	1	2	3	4
I find integrating technology into my lesson plans an easy task.	1	2	3	4
People who influence my behavior think that I should integrate technology into my lesson plans.	1	2	3	4
Integrating technology into my lesson plans is voluntary.	1	2	3	4
My principal does not require me to integrate technology into my lesson plans.	1	2	3	4
People in my organization who integrate technology into their lesson plans have more prestige than those who do not.	1	2	3	4
People in my organization who integrate technology into their lesson plans have a high profile.	1	2	3	4
In my job, technology integration in my lesson plans is important.	1	2	3	4
In my job, technology integration in my lesson plans is relevant.	1	2	3	4
The quality of the output I get from integrating technology into my lesson plans is high.	1	2	3	4
The results of integrating technology into my lesson plans are apparent to me.	1	2	3	4
I have no difficulty telling others about the results of integrating technology into my lesson plans.	1	2	3	4
SELF-EFFICACY QUESTIONS ***Read each statement below. Indicate how much you (1) strongly disagree to (4) strongly agree with each statement.*** ***1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree***				
SELF-EFFICACY TOWARDS TECHNOLOGY INTEGRATION				

I feel confident that I can integrate instructional technology as a meaningful part of my teaching.	1	2	3	4
I feel confident that I can find new ways to apply instructional technology in my teaching.	1	2	3	4
I feel confident that I can create meaningful learning experiences for my students with instructional technology.	1	2	3	4
I feel confident that I can apply instructional technology to enhance my students' learning.	1	2	3	4
COMPUTER SELF-EFFICACY				
I feel confident that I can use instructional technology efficiently.	1	2	3	4
I feel confident that I can learn to use instructional technology tools independently.	1	2	3	4
I feel confident that when I use instructional technology, I can solve technical problems if I face them.	1	2	3	4
I feel confident that I am able to download programs on the Internet.	1	2	3	4
TEACHER SELF-EFFICACY				
I feel confident that I can create meaningful learning experiences for my students.	1	2	3	4
I feel confident that I can motivate my students to be actively involved in their learning.	1	2	3	4
I feel confident that I can develop my teaching.	1	2	3	4

APPENDIX D

SAMR Rubric

SAMR rubric based on Ruben Puentedura's (2006) definitions.

SAMR Level	SAMR Definition
Substitution	Technology acts as direct tool substitute, with no functional change
Augmentation	Technology acts as direct tool substitute, with functional improvement
Modification	Technology allows for significant task redesign
Redefinition	Technology allows for the creation of new tasks, previously inconceivable